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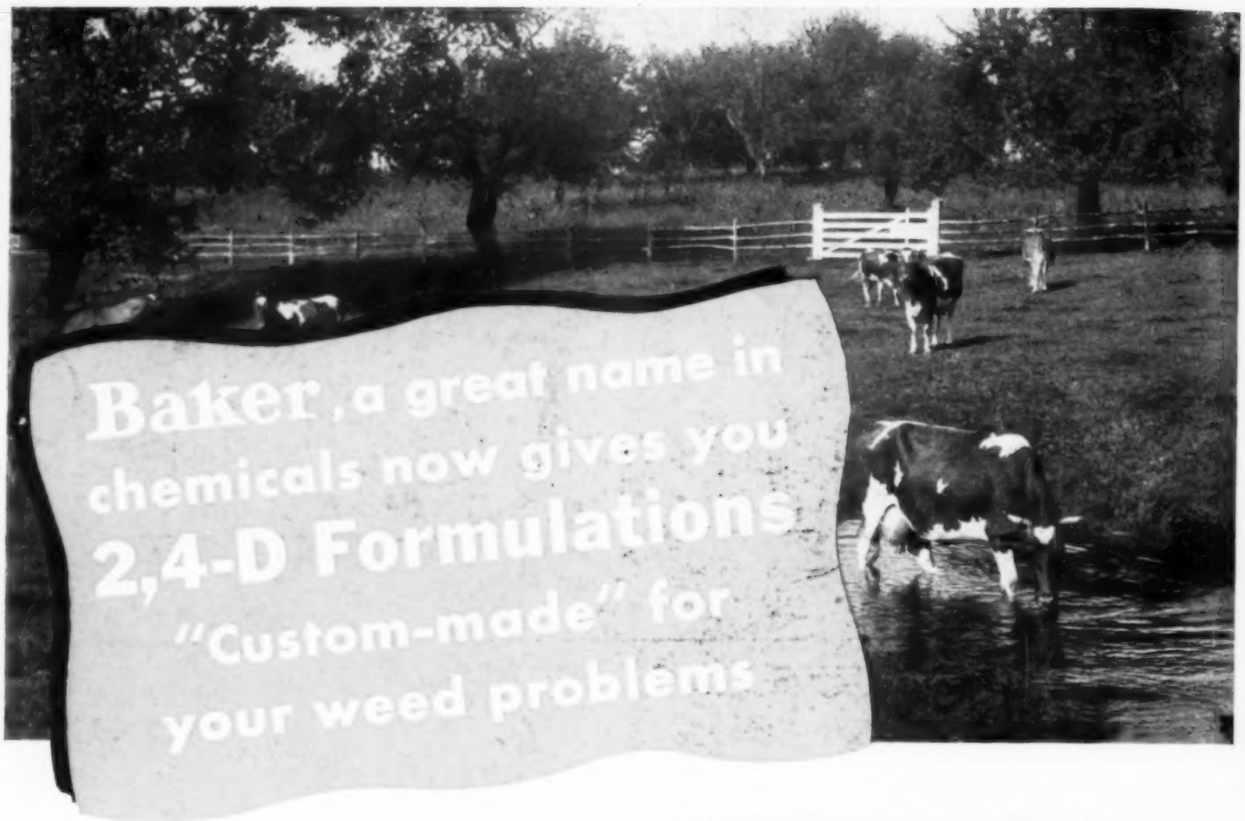
Volume II August, 1947 Number 8



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AGRICULTURAL CHEMICALS

A Monthly Magazine For the Trade

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THIS MONTH'S COVER

New mechanical equipment for fertilizer application is much in evidence in agricultural America. The cover photo shows a tractor equipped for applying fertilizer materials just under the ground. Such a device is adjustable for various crop needs. Other photos with article on page 21. (Courtesy Pacific Guano Co., Berkeley, Calif.)

AUGUST 1947
VOL. II No. 8

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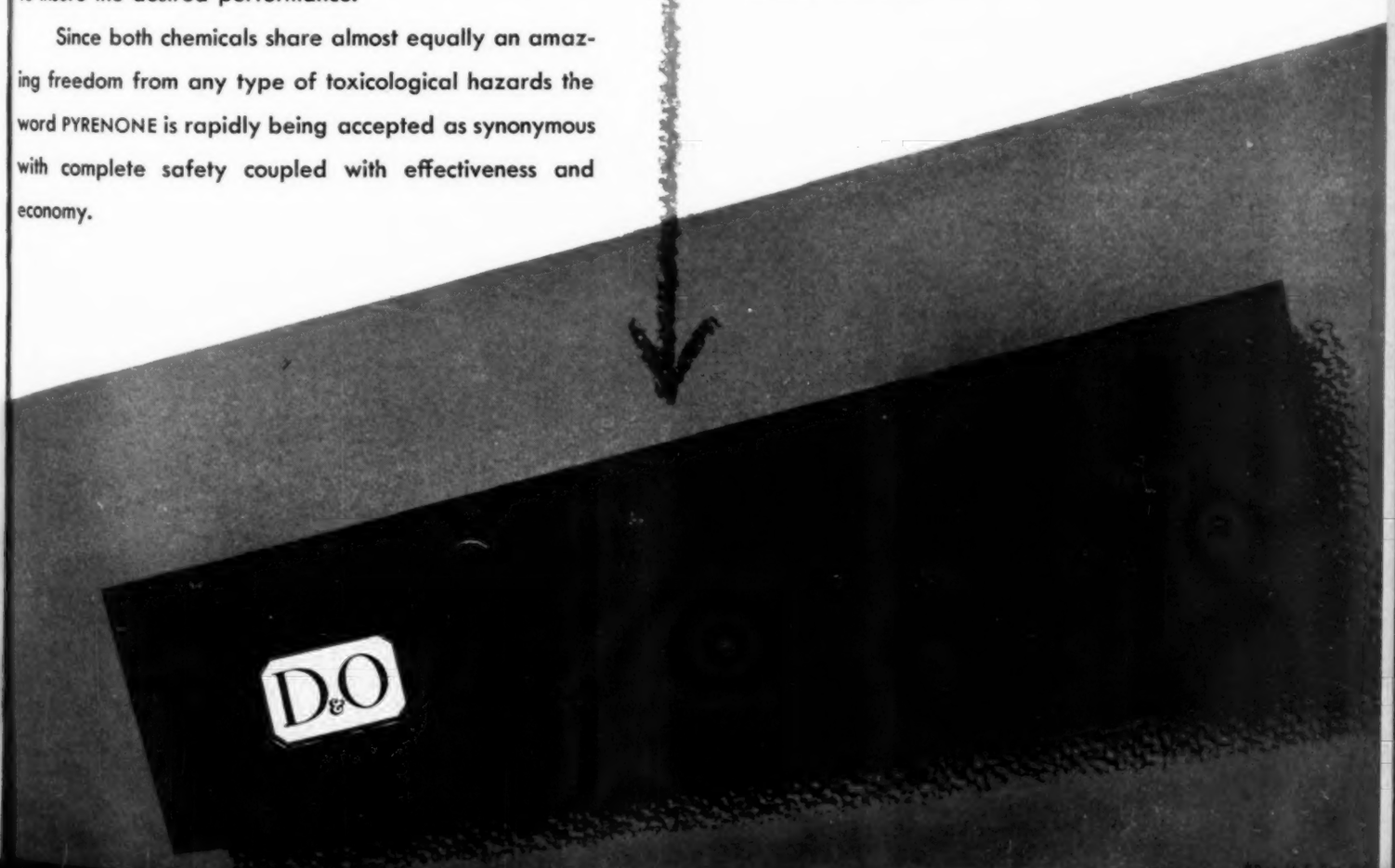

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Check these features

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2. pH range of 5.4 to 6.5.
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5. Inert to almost all insecticides.
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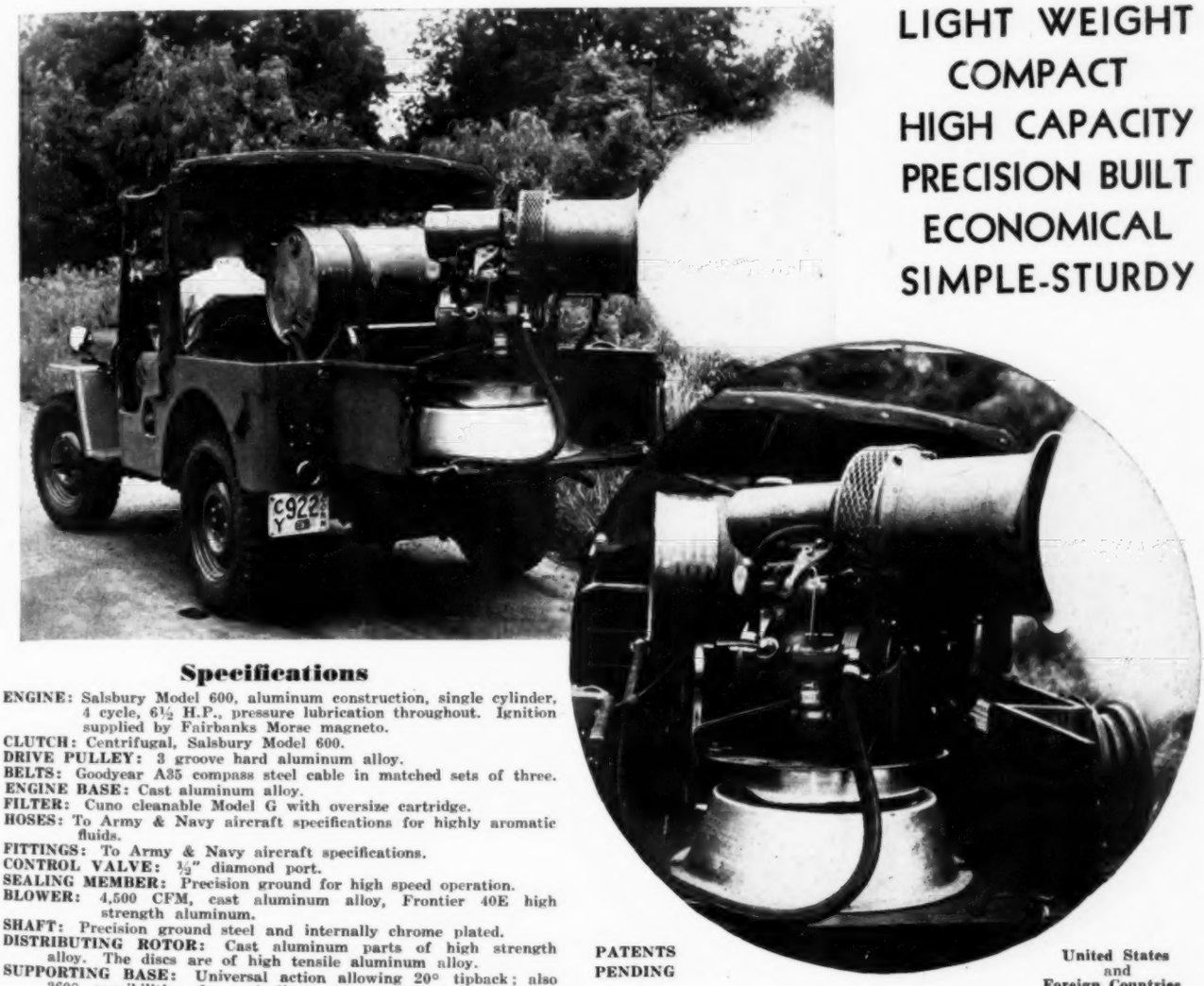

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COMPACT
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PRECISION BUILT
ECONOMICAL
SIMPLE-STURDY

Specifications

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CLUTCH: Centrifugal, Salsbury Model 600.
DRIVE PULLEY: 3 groove hard aluminum alloy.
BELTS: Goodyear A35 compass steel cable in matched sets of three.
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SEALING MEMBER: Precision ground for high speed operation.
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FOR FURTHER DETAILS WRITE TO

Hession Microsol Corp. DARIEN, CONN.

Thanks!

That's an appropriate expression from us to the agricultural chemical field as this season draws to a close. It means we are aware of the effective service —in home, field, orchard, barn or granary—rendered by your many new or improved materials and techniques; the satisfying fruition of your plans and sweat.

And thanks for buying and using Attaclay in unprecedented tonnages. In your hands, our product has been proved—brought to its high level of acceptance as an outstanding carrier and diluent of pest-and disease-control toxicants.

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But we're doing something about that for the 1948 season! Our laboratory already has been enlarged. New plant facilities will greatly expand the production of this carefully manufactured and controlled product.

We're going to make sure you'll get the technical assistance you want and sufficient Attaclay to meet your needs.

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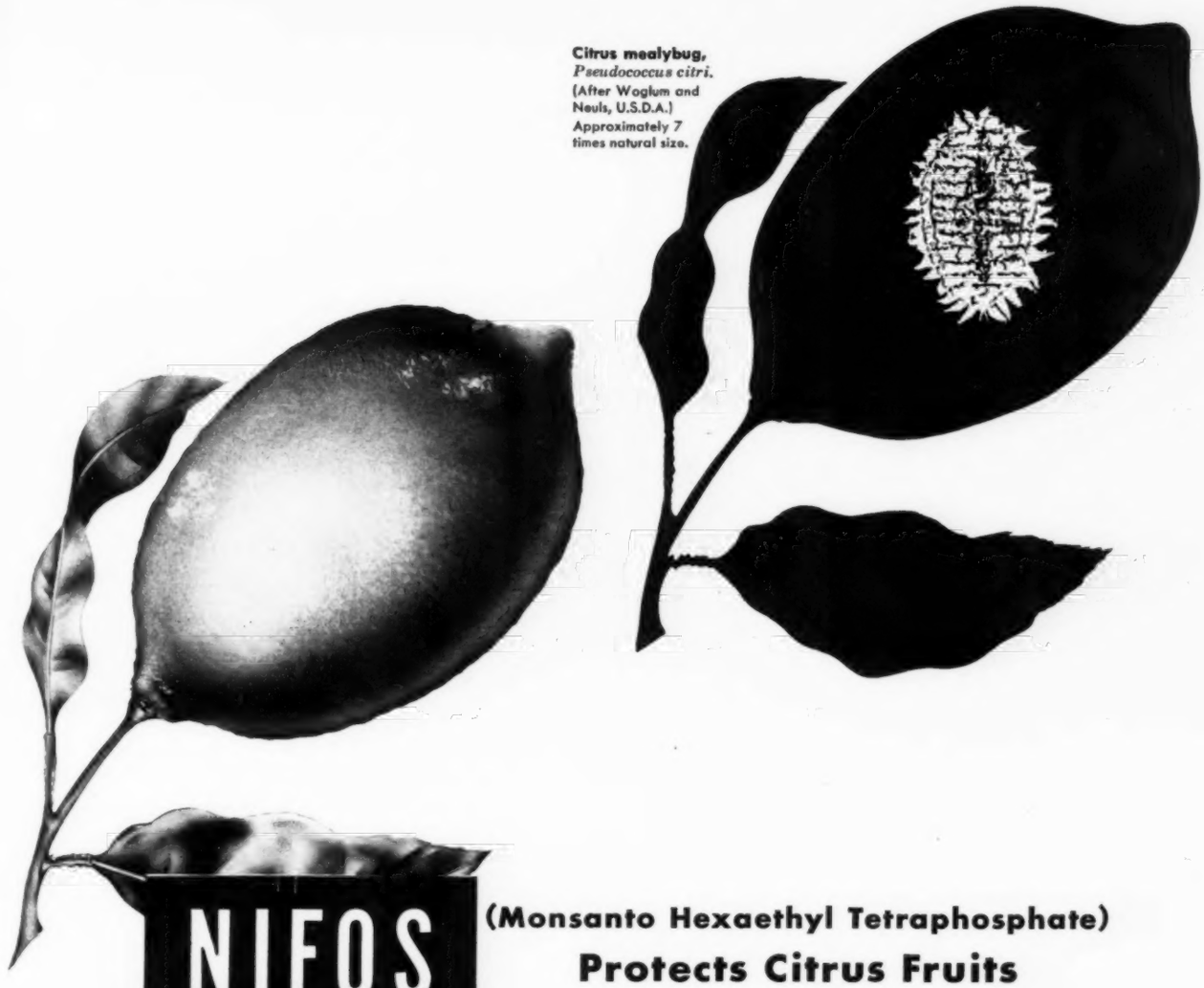

Citrus mealybug, *Pseudococcus citri.* (After Woglum and Neuls, U.S.D.A.) Approximately 7 times natural size.

NIFOS

(Monsanto Hexaethyl Tetraphosphate)
Protects Citrus Fruits

The citrus mealybug is another of the many agricultural pests that are successfully controlled with Nifos — Monsanto's Hexaethyl Tetraphosphate. When properly formulated and applied, it is non-injurious to most botanicals.

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For detailed technical information on Nifos, write to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

MONSANTO
CHEMICALS ~ PLASTICS

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Apricot	Firebush	Rose
Barberry	Gardenia	Snapdragon
Bean	Geranium	Spiraea
Carnation	Grape	Stock
Cherry	Lantana	Sweet Potato
Coleus	Lemon	Syringa
Eggplant	Lilac	Walnut

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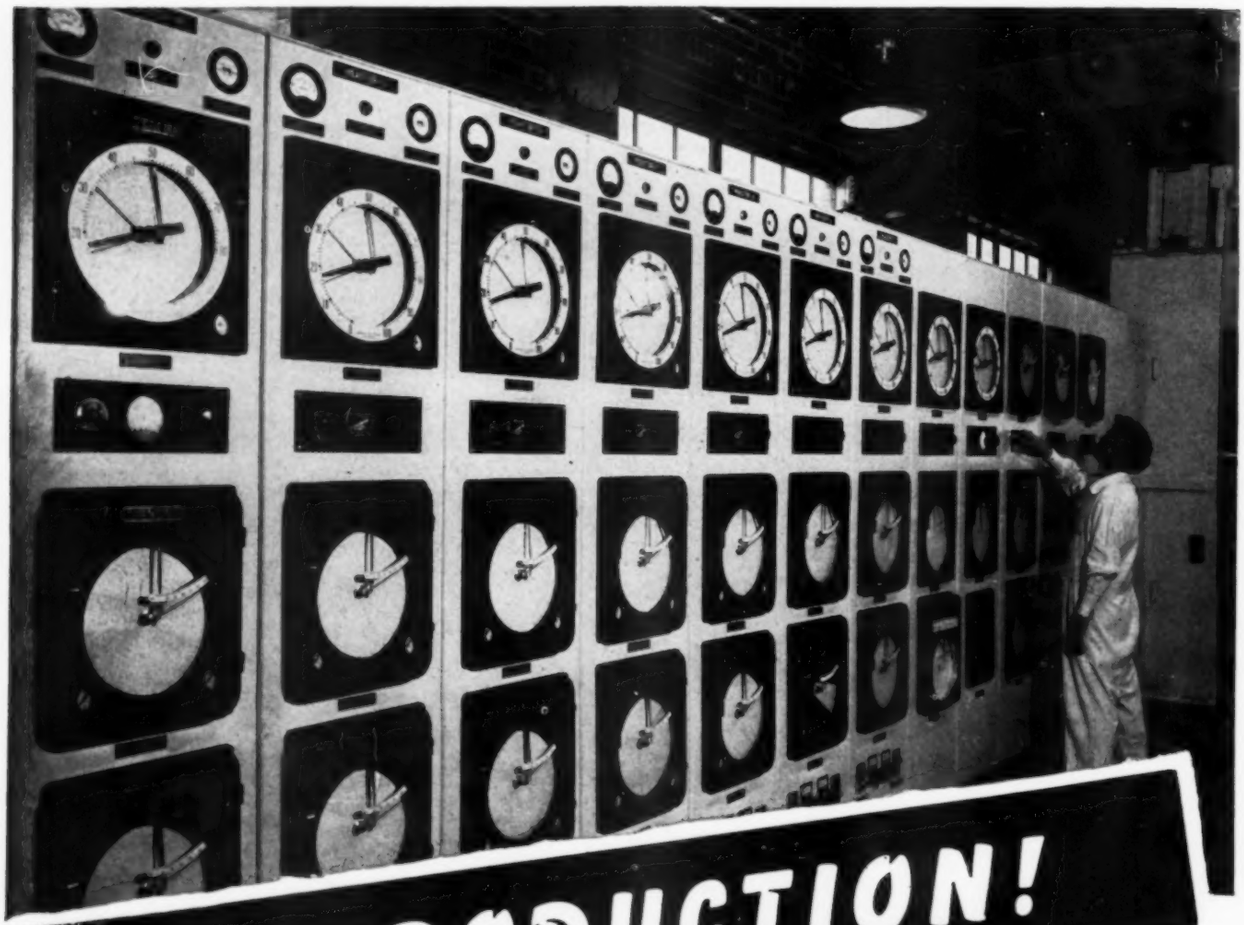
this central control panel is the key to the new CSC continuous process.



IN PRODUCTION!

new CSC benzene hexachloride plant

CSC's new continuous process plant is now producing benzene hexachloride of a uniform gamma content and a greatly reduced odor.

☆ This promising insecticidal material is now available to major manufacturers of insecticides for both domestic and export sale.

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Cube Powder—4 - 5% Rotenone
5% Rotenone Oil Concentrate

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30% DDT Oil Concentrate
DDT plus Rotenone Emulsifiable Concentrate
50% DDT Wettable Powder Concentrate
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There's no worry about quality when you specify Powco Brand. It is this symbol of quality that enables insecticide manufacturers to put out their own distinctive products—the finest obtainable.

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TECHNICAL GRADE DDT — Minimum set point 89°C.

JP25—Liquid, water miscible DDT spray concentrate with 25% by weight of technical grade DDT plus solvent.

JP50—Micron sized DDT dust concentrate with 50% by weight of technical grade DDT.

JP50W—DDT wettable powder concentrate of extremely fine particle size with 50% by weight of DDT technical.

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THE EDITOR COMMENTS

STRONG opposition by members of the fertilizer industry before the Senate Agricultural Committee no doubt had an important bearing on the decision to deny the TVA's request for some $10,300,000 for construction work including new government fertilizer plants. Instead, the agency was restricted to $3,000,000 for chemical plant maintenance and replacement and another $3,000,000 in operating funds, out of which must come expenses of its fertilizer demonstration program and all other development work. To illustrate the mood of the Senate, an attempt to gain an additional $2,500,000 to prevent curtailment of the demonstration program, was also lost on a decision vote. The Senate further directed that TVA coordinate its fertilizer research program with that of the U.S.D.A.

The fertilizer industry accomplished a real job in fighting to a standstill this latest threat of government interference and competition in its field. However, the necessity of vigilance has not passed. The danger of this threat to the industry will always be with us . . . at least until the last vestige of "new dealism" is cleaned out of Washington and our Government agencies.

THE East African Pyrethrum Board shows wisdom, we feel, in recommending to Kenya growers that despite existing contracts and agreements, they should accept a lower price during the remainder of 1947. The Board, which guaranteed the price to the growers, now finds itself in an embarrassing position with the growers clamoring for sustained prices on one hand, and on the other hand knowing that supply has overtaken world demand for pyrethrum flowers and that a considerable carryover exists. Also in their thinking must be included the competition from new synthetic insecticides, as well as increasing competition from pyrethrum flowers grown elsewhere.

American importers have termed the rumor of a price reduction as "wishful thinking," and express doubts that there will be lower prices for pyrethrum flowers before 1948, since the growers are legally entitled to the agreed price under their contract with the British Board of Trade. Whatever the course, however, the future trend of pyrethrum price promises to be watched with keen interest. The East African Pyrethrum Board obviously recognizes the handwriting on the wall, so far as competition is concerned.

FEAR of the spread of the golden nematode from Long Island is expressed by officials of other potato-growing regions of the country. Senator Owen Brewster of Maine has urged Secretary of Agriculture Anderson to ban interstate shipment of potatoes from infested areas, lest the parasite be spread elsewhere.

Senator Brewster is correct in that the introduction of the nematode into Maine would be a tragic event, but apparently uninformed as to steps being taken by the U. S. Department of Agriculture and the State of New York to control the pest. Chester DuMond, Commissioner of the New York State Department of Agriculture and Markets characterized Senator Brewster as being "over-alarmed about this thing." The New York Commissioner points out that "the only place in North America where the golden nematode has been discovered is in Nassau County on Long Island, and we have had 3,500 acres of land under quarantine there for the last three or four years, ever since the nematode was discovered there . . . We are doing all we can with science and money."

While no infected potatoes have knowingly been shipped out of the nematode areas and wide chemical control has been undertaken, U.S.D.A. officials point out that before the quarantine some tubers may have found their way to other points, and used bags may have been sold to potato growers elsewhere. Absolute control of the nematode may not be impossible, but obviously is almost so. Had the senator known what has been and is being done, he would probably be less alarmed in spite of the still serious nature of the situation.

Guest Editorial written especially for this issue of Agricultural Chemicals.

Milestones in history of chemical fertilizers

By

Charles H. MacDowell

Retired vice-president and member of the board, Armour & Co.; for many years president of Armour Fertilizer Works, and former president of National Fertilizer Association.

IT was back in 1887, while Philip D. Armour's personal stenographer, that I first heard of the "artificial manure" industry. At that time Armour was winning rough ammoniates and bone tankages from offal and selling the product to fertilizer maufacturers. The chemical fertilizer industry was then forty-five years old.

Six years later, after a general survey of fertilizer operations, I reached the conclusion that Armour should organize a fertilizer department, in order to handle by-product problems better; they should manufacture commercial fertilizers and other products of higher economic value; that the department should be staffed in part by young chemists and engineers, as well as business go-getters. I wrote Mr. Armour early in 1893, suggesting that I would like to undertake this development. The letter expressed the belief that it was a growing primary food industry, and that it would be of great benefit to Armour & Company if a man would get real close to it from a chemical as well as a business standpoint. I still have that letter, with his "O.K., P.D.A."

The history of the chemical fertilizer industry is interesting. Chemical treatment of phosphates to render them available as plant food began in 1842 when John Bennett Lawes began the commercial manufacture of superphosphate at Bow, England, using bone waste products and sulphuric acid as his raw materials. A Professor Henslow brought Lawes some coprolite nodules he had found in a Suffolk quarry, which he claimed were suitable for making superphosphate. The nodules contained 50-55% calcium phosphate. His statement proved true. Concurrently James Murray, an Irish chemist, took out a patent for the acidulation of fossil bone, of which Lawes later made use. The basic technique developed by Lawes, with many mechanical improvements of course, is still being used by superphosphate producers.

(*Continued on Page 53*)

Marketing Small Package
Agricultural Insecticides

Dr. M. H. Doner
The J. R. Watkins Company
Winona, Minn.

GARDENING is an established principle in American living. The total value of vegetables raised in home gardens in 1929 exceeded a quarter of a billion dollars.[1] In normal peacetime years there are about 8,000,000 gardens in the United States. The significance of insecticides and fungicides for controlling insects and diseases in these vegetable gardens is obvious.

During the early war years the United States Department of Agriculture initiated a "Victory Garden" program based on the slogan that "Food Will Win the War and Write the Peace." In 1943 the number of gardens in the country had increased to 20,000,000 and it appeared that there would probably be another 2,000,000 gardens in 1944. In 1943, according to the *National Garden Review*, gardeners produced 42% of all the vegetables grown. Gardeners in towns and cities contributed 17% of all the vegetables produced. From the economic standpoint, these Victory gardens saved $1,250,000,000 of the country's total food bill according to the American Institute of Food Distribution. In that year 8,000,000 tons of vegetables and fruit were produced, 2,400,000 tons from the so-called Victory Gardens. In one week during the fall of 1944 over 100,000,000 pounds of fruits and vegetables were produced in city family gardens, or 15% of all fruits and vegetables used by urban households.[2]

The urgency of maintaining victory gardens appears quite evident in view of the fact that tremendous quantities of food supplies will apparently have to be exported to meet the food crisis of Europe.

The trend in vegetable gardening at the present time appears good, as evidenced by the following communication from R. J. Haskell, Acting Extension Horticulturist of the U. S. Dept. of Agriculture: "I would say that the interest in gardening seems to be holding up remarkably well when we consider that the war is over. Judging from the reports coming in from the States, I would say that interest is still running quite high. It seems that many gardeners have got in the habit, and many amateurs have got in the habit and will continue to grow vegetables. Probably the total number will not reach that of the war years which has been variously estimated between 18 and 20 million and the number will probably not reach that of last year. One contributing reason is that real estate companies are building on or reserving lots which have served the useful purpose of a Victory Garden during the war."

As a market for small package insecticides, gardens in rural and city areas present tremendous possibilities. It has been estimated that 22,000,000 gardens would require about 25,000 tons of insecticides or an equivalent of 16 train loads of 100 cars each, which, as Parks[3] suggests is "quite an imposing lot of ammunition to use on home garden enemies."

Dealer-Consumer Education

EXPERIENCED vegetable gardeners understand the urgency of insect pest control and are generally well equipped to apply insecticides properly. On the other hand, there are perhaps many more gardeners who have learned that insects must be controlled, but lacking information of the habits of the common vegetable pests and having had little or no experience with insecticides, have not always been successful. Many gardeners not only lack understanding of the typical life history of an insect but are not aware of the differences between chewing and sucking insects and the important relationship between feeding habits and the action of contact and stomach poisons, The inability to distinguish between the symptoms of plant damage caused by virus and fungus diseases as against damage caused by insects has often lead to unjudicious use of insecticides. Again there is the common tendency of gardeners to apply treatments after the damage has been done. In such cases, the insecticide is judged as ineffective or as being the cause of "burning" of the foliage, which actually may not be the case.

The importance of the dealers in getting recommendations across to the consumer, as discussed by Dr. Charles E. Palm at a meeting of the Agricultural Insecticide & Fungicide Association last April, cannot be over-emphasized. "Where, only a few years ago dealers had only a few standard insecticides to deal with, today he is faced not only with a variety of new materials but a large number of formulations of a single material like DDT." Recommendations on labels frequently differ. In short, the dealer is confused and does not know what recommendations to make that will result in consumer acceptance of the product. The writer has endeavored to overcome

[1] War Prod. Ad. Nat. Res. Project, Rept. No. A, 12, 1939.
[2] Mo. Labor Review 1945, 61(4):644.
[3] J. Econ. Ent. 1944, 37(3):354.

Wide variety of new toxic materials and many formulations of same material, like DDT, make dealer education very necessary

this at regional sales conferences of his company. These meetings are held in advance of the insect season, and enough time is allowed to permit a thorough going discussion of the basic principles of insect control, together with a careful consideration of the place of the newer materials in the garden pest control program. Movie films and slides about insects and their control are considered important visual aids and a stimulus to greater interest in problems of pest control. Monthly bulletins are sent to the dealers informing them of altered or improved recommendations. Illustrations are used to a maximum, and proper application is stressed. Dealers are also urged to see that purchasers are properly equipped with dusters to obtain effective control. The results of such meetings have been what would be expected. Our dealers, selling as they do from house to house, farm to farm, as a result of these sales conferences are better equipped to serve their customers in an intelligent manner.

In developing insecticides for use in gardens the Watkins Company has:

1. Avoided the use of insecticides that leave highly dangerous residues on the plant. It has been found that gardeners prefer a dust which can be used on fruits and vegetables without being a serious health hazard. It is doubted if many gardeners have any concept of the established tolerances for various poisons, nor, that when highly toxic materials are used early in the season, that it is advisable to use a less toxic material later in the season when the plants are maturing, to avoid harmful residues. In actual practice in home gardens, insecticides are applied at dosages often in considerable excess of that needed for satisfactory insect control in the belief that if a small amount is effective even better results should be obtained by using more. This practice only aggravates the residue problem and may in some instances result in plant injuries that would not be experienced with lighter applications. On the other hand, Sherfakoff and Stanley of the Tennessee Station[4] contend that poisoning of people eating insecticide residues is "highly improbable" and produce evidence to show that a toxic dose of lead arsenic might be possible at a dosage of 6,000 pounds per acre of beans which is 400 times the amount recommended for control of insects on this crop.

2. Kept the insecticide line as simple as possible, thereby avoiding the tendency to develop formulations for special insect pests. Dealers who sell directly to the consumer, are frequently asked for recommendations to control certain kinds of insects and are confused in selecting from several products the insecticide that will do the most effective job. Providing dealers with descriptive literature about the products is certainly helpful—but in some cases it is not properly studied and the dealer is no better off than before. The problem, therefore, is one of developing a product which, when properly employed, will be effective against the run-and-file of vegetable insects. This may involve the use of more than one toxicant in a formulation, the theory being that if one agent is not effective, another might be. And it is hoped, perhaps vainly so in many instances, that by compounding several toxicants a synergistic action will occur which will result in a control superior to a product that involves a single toxicant.

Consideration of Toxicants

THE use of DDT (diphenyl dichloro trichloroethane) is rapidly gaining favor as an agricultural insecticide for the control of certain insects. Although a poison, in the dosages recommended for insect control on vegetables there are no dangers if applications are made to avoid residues on parts of the plant that will be eaten. Because DDT residues are not readily removed by washing, it appears unwise to treat lettuce, Swiss chard, spinach, beet tops used as greens, ripening tomatoes and on other plants for human use.

If DDT is to be recommended on labels for the control of cucumber beetles, melon worms, pickle worms and other pests of the cucurbit or gourd family, a cautionary statement to avoid heavy applications is advisable. Members of this family, particularly certain varieties, are susceptible to DDT and in many cases of practical use, DDT dusts have either injured plants or resulted in reduction in yields.

Satisfactory diluents and insecticides for preparing DDT dusts include talc, clay, sulfur, pyrophyllite, cryolite, rotenone, and pyrethrum. To be avoided are alkaline materials such as lime, Bordeaux, bentonite, and Fuller's Earth.

DDT residues are affected by sunlight and control cannot be expected on plants for as long a period as obtains for deposits in buildings for fly control. To maintain effective control of plant insects with DDT, repeated applications every two or three weeks may be necessary.

Technical grade DDT or "DDT setting point 89° C." is a crude mixture of several isomers and impurities. Roughly, 75% of the crude material consists of the highly insecticidal para para isomer, about 20% of the ortho para isomer which is somewhat insecticidal, and about 5% of impurities that have no value for killing insects. For labeling purposes in most states and to comply with Federal requirements it is acceptable to declare the total percentabe of crude material as "Diphenyl dichloro trichloroethane, setting point 89° C." Californa has ruled that the percentage of each isomer must be stated separately:

Active ingredients
pp' Dichloro-diphenyl-trichloroethane .....xx%
Other isomers of dichloro-diphenyl-trichloroethane xx%
Inert Ingredients .....xx%

or, in lieu thereof, to show only the percentage of the para para isomer.

[4] Tenn. Expt. Sta. Bul. No. 186, 1943, page 131.

Cube, Timbo, Derris, Etc.

ROTENONE, and the other active chemical constituents of these plants are highly toxic to many insects. Insecticides containing from 0.5% to 1.00% rotenone have become thoroughly established for use in gardens, chiefly because their use entails no danger from residues on fruits and vegetables. Where many highly poisonous materials cannot be used except early in the season when there is no particular residue problem, insecticides containing rotenone may be employed to check infestations on matured fruits and vegetables.

Although not spectacular in action against insects as is pyrethrum, rotenone produces a fairly rapid paralysis of insects, to which the consumer attaches considerable significance.

In common with other insecticides, rotenone-containing roots show a marked specificity to certain insects (such as Mexican bean beetle, cabbage caterpillars, pea aphid, pea weevil, flea beetles and asparagus beetles) yet, notwithstanding, are among our most widely useful garden insecticides for many chewing and sucking insects.

Dusts prepared with alkaline diluents (hydrated lime, diatomaceous earth, certain talcs and clays, bentonite, limestone) deteriorate, a fact that must be kept in mind if packaged dusts are to have a relatively long shelf life or are not held in a dry environment when in the hands of the consumer.

The finished dusts previously mentioned can be compounded from a ground root containing 4 to 5% rotenone and approximately 2½ to 3 times as much of other extractives as follows:

5%	0.5%	*rotenone:*—	1	*part*	*of*	*root,*	9	*parts*	*of*	*diluent.*
	0.75%	"	1	"	"	"	5.7	"	"	" .
	1.00%	"	1	"	"	"	4	"	"	" .
4%	0.5%	"	1	"	"	"	7	"	"	" .
	0.75%	"	1	"	"	"	4.5	"	"	" .
	1.00%	"	1	"	"	"	3	"	"	" .

Many precautions to be observed in packaging insecticides. Compatibility of toxic material with diluents, and labeling of most importance

The label for rotenone-bearing dusts should show (1) the percentage of rotenone and (2) the percentage of total ether extractives other than rotenone since these are considered active ingredients.

Pyrethrum

THE active principles of pyrethrum, Pyrethrins I and II, are highly toxic contact poisons. Dusts containing powdered pyrethrum with a pyrethrin content of 0.1% to 0.3% have been widely used for the protection of sween corn, beans, potatoes, cabbage, cauliflower, broccoli, brussels sprouts, celery, melons, squash, cantaloupe, and lettuce, against leaf tiers, plant bugs, and leafhoppers. Two features of pyrethrum insecticides that make for consumer acceptance are (1) their relatively quick action against insects and (2) that the residues left on the foliage are comparatively harmless to higher animals and man and that dusts can be applied shortly before harvest time. To offset these advantages partially, it may be said that pyrethrins quickly lose their killing power when exposed to air and light thus necessitating, in some instances, frequent treatments. This deterioration is said to occur to a slight extent even in air-tight containers.

Care must be taken in manufacturing pyrethrum dusts to avoid using diluents in which pyrethrins are unstable such as hydrated lime, Bordeaux Mixture and other alkaline materials.

Since the active constituents of pyrethrum are Pyrethrins I and II, their total percentage should be stated on the label.

Sabadilla

THE seed of a lily-like plant (*Schoenocaulon officinale*) contains alkaloids which, when activated by heat or lime, are highly toxic to sucking plant bugs against which rotenone and pyrethrum are only partially effective. Dusts containing 20% of activated Sabadilla have given good control of the squash bug, harlequin or "Collard" bug, various species of leafhoppers, and cabbage caterpillars. Dusts containing sabadilla are slightly irritating and care must be exercised in making applications to avoid breathing the dust particles. Dr. T. C. Allen and his associates at the Wisconsin Station have done considerable toward overcoming successfully this objection, the details of which will be published by Dr. Allen in the near future. Sabadilla residues are not toxic to man and animals.

Cryolite

CRYOLITE is a stomach poison commonly used against certain tomato insects, the lime bean pod borer, corn earworm, the velvet-bean caterpillar, pepper weevil, blister beetles, flea beetles and cucumber beetles. It is ineffective against sucking insects such as leafhoppers, aphids and plant bugs.

Although cryolite is firmly established in the southern states where it has been recommended and used for a number of years, experience with cryolite dust has not been too satisfactory in other areas where cryolite was introduced as a replacement for rotenone insecticides during the war years. There were a number of complaints that it was ineffective on cabbage worms and potato bettles, but it appears that these dusts were

used without due respect to label recommendations against insects for which cryolite has no value. Many consumers, having previously had experience with rotenone materials, were dissatisfied with cryolite because of its relatively slow action against insects. Wene and Rawlins[5] have reported that from 3 to 5 days are required to give more than a 50% kill of Mexican bean beetle larvae.

As a substitute for rotenone, Turner[6] observed that a 50% cryolite dust was no more effective against the Mexican bean beetle than a 0.25% rotenone dust; for cabbage worms, especially loopers, 12.5% cryolite was more effective than 0.5% rotenone; and for potato flea beetles, 50% cryolite was slightly less effective than 0.5% or 1.0% rotenone.

The insecticidal value of cryolite is based on the sodium fluoaluminate content which varies in commercial dusts from 25% to 70%. It would seem advisable, as suggested by Dr. Cox,[7] to simplify marketing by limiting the grades to three—35%, 50% and 65%, these figures referring to the sodium fluoaluminate content. It was suggested that a dust called cryolite dust 35, for instance, should contain 35% of sodium fluoaluminate or approximately 40% of cryolite.

Sodium fluoaluminate tends to lose its effectiveness against insects when mixed with hydrated lime and other calcium compounds. Talc, sulphur and diatomaceous earth have been successfully employed.

Benzene Hexachloride

"HEXACHLOROCYCLOHEXANE," is a new material that has shown promise as an agricultural insecticide. It acts as a stomach poison, contact insecticide and fumigant. An objection to this matrial is the strong, persistent, musty odor that causes a taste contamination problem of fruits and certain vegetables. Until the odor of the material can be improved by further research, hexachlorocyclohexane can not be recommended for the control of vegetable insects. Bottger and Levin have shown that under laboratory test dusts containing up to 2% gamma isomer were more toxic than DDT to the melon worm, southern beet webworm, imported cabbage worm, and corn earworm; but were ineffective against the celery leaf tier. Aphids on spinach and turnips have been successfully controlled with 0.75% gamma dusts by Isley and Miner,[9] where nicotine, rotenone and rotenone-sulphur dusts were ineffective under field conditions. The excellent results were attributed to the fumes of the compound reaching the aphids and killing them in temperatures at which nicotine dusts were ineffective.

A dust containing 5% of hexaethyltetraphosphate (HETP) has been shown to be superior to nicotine against the cabbage aphid but, since these results obtain only for freshly prepared mixtures, this toxicant can not be considered suitable for small package merchandizing at present.

Combination Insecticides

THE insecticidal activity of any single toxicant, as far as practical insect control is concerned, is limited to certain specific insects. This means that if the insecticide is used promiscuously without regard to the specific recommendations on the label, the product will be unwittingly used by consumers against all insects and the results in some instances may be disappointing. To achieve a product capable of controlling a wide range of insect pests, manufacturers have shown a tendency within recent years to depend upon more than one toxicant in a formulation. In general, the idea is that if one toxicant fails to control a certain insect, chances are that the other toxicant or toxicants will produce the desired results. Such "all-purpose" insecticides appear to be most desirable, for the average consumer who knows little or nothing about insects and their control. The incorporation of a fungicide in the combination further increases the value of the product although it must be pointed out that disease control is largely one of prevention, rather than one of cure, and it is necessary to make applications before or during the initial stages of disease infection.

Pyrethrum and rotenone make a combination that has been frequently used. Here we have a product that gives a high, quick initial kill of insects and protection of the plant for several days. The same principle obtains in the use of sabadilla and DDT. Dusts containing 10% of sabadilla and 1% to 5% of DDT have been used successfully, especially on cucurbits for the control of squash bugs, striped and spotted cucumber beetles and squash borers. The sabadilla produces a quick kill of insects while the DDT continues to exert a residual effect that delays or prevents reinfestation.

The possibility, therefore, of utilizing more than one toxicant in a formulation is of great interest but it is essential that combinations be made on the basis of practical field tests rather than on preformed conclusions as to result that might be expected.

Legal Considerations*

UNDER the federal insecticide act of 1910 manufacturers were given two optional methods of stating ingredients, namely:

1. The name and percentage amounts to each inert ingredients, or
2. The names and percentage amounts of each active ingredient and the total percentage of inert ingredients.

The same requirements as above exist in the following state laws: Alabama, Arizona, California, Colorado, Connecticut, Florida, Minnesota, New Hampshire, New Jersey, Ohio, Pennsylvania, Tennessee, Texas, Utah, Washington, and Wisconsin.

The following states have non-uniform labeling requirements: Arkansas, Georgia, Iowa, Louisiana, Maine, Maryland, Michigan, North Carolina, Oregon, South Carolina, and Virginia.

At the present time the following states do not have insecticide and fungicide laws: Delaware, Dis-

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[5] Jour. Ec. Ent, 1945, Vol. 38 (6) :656.
[6] Ibid, 1944, Vol. 37 (2) :244.
[7] Calif. Bureau of Chem., Announcement EP-47, May 28, 1945.
[8] Jour. Ec. Ent. 1946, Vol. 39 (4) :539-40.
[9] Ibid., :550.

* The information presented applies only to the time the article was written. Certain states have passed bills subsequent to that time.

Application Machinery for FERTILIZER

By Glenn A. Cumings*

Sr. Agricultural Engineer, Div. Farm Power and Machinery, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Reseach Adm., U.S.D.A.

AS agriculture moves toward its highest efficiency in the use of commercial plant food, attaining a scientific balance of all conditions and adopting proper methods of application become increasingly important. Placement of the fertilizer is the last operation under the control of the farmer, and this step has been found vital in putting into practice the knowledge gained through research.

The Bureau of Plant Industry, Soils and Agricultural Engineering of the U. S. Department of Agriculture has for a number of years been studying better methods of fertilizer application, and devising machinery for proper distribution. Much attention has been given to the placement in the soil, especially the pattern and position of the fertilizer application with reference to the seed or plant roots. In this connection, the Bureau has designed and built 34 special field machines, and has participated in 648 fertilizer placement experiments with 37 crops in 25 states. In addition, many experiments have been conducted by state experiment stations and other research agencies.

Much of this advancement must be credited to the National Joint Committee on Fertilizer Application which brought together the national organizations of Fertilizer Manufacturers, Implement Manufacturers, Agronomists, Horticulturists and Agricultural Engineers to work out the problems involved. Sustained joint effort over a period of 22 years is an unusual record for the committee, and it is now continuing to function as effectively as it has in the past.

Records of the Joint Committee show that at the end of this season, approximately 2,500 fertilizer-placement experiments will have been conducted during a 19-year period in 46 states, with 55 crops. Although there are many crops not covered in this research, many opportunities are yet ahead for advancement in applying the accumulated knowledge on how to use fertilizer materials more intelligently and efficiently. This eliminates many errors.

In order to establish an improved method of applying fertilizer on a large scale in farm practice, the required mechanical provisions must be incorporated in machines offered to the farm trade. The fertilizer placement feature of many machines such as potato planters, corn and cotton planters, transplanters, vegetable crop drills and tractor attachments have been improved and are now accepted as conventional designs.

Some of the changes now creating new demands and new problems with regard to fertilizer application equipment are listed as follows: The recent use of greatly increased amounts of fertilizer per acre; the application of fertilizer in areas where little or none was used before; the interest in liquid materials; the more general use of tractor power and heavier tractor-operated machinery; the desire to cover larger acreages per day with reductions in man labor and fewer interruptions; and the exacting requirements for individual crops and

Above: How fertilizer application tractor is transported from place to place. Machine on trailer is same one pictured on front cover, this issue. (Photo from Pacific Guano Co., Berkeley, Calif.)

* From talk presented at N.F.A. Convention, Spring Lake, N. J., June 20, 1947.

conditions resulting from increased scientific knowledge.

New requirements have caused the appearance of more machines than can be mentioned here. Several hundred different machines were built by more than 100 manufacturers before the war and during the past two years additional manufacturers have started developing and producing fertilizer distributing machines. Four groups of machines are selected to indicate typical new trends. These are listed as follows:

(1) *Tractor - mounted fertilizer equipment.*
(2) *Equipment for deep placement of fertilizer.*
(3) *Equipment for applying fertilizer in liquid form.*
(4) *Broadcasting equipment.*

Tractor-mounted Equipment

THE development of a suitable fertilizer attachment for the general purpose tractor is of far-reaching significance because of the use of tractor power on most of the farms. Furthermore, progress toward mounting more interchangeable planting, transplanting, and tillage units on the tractor with convenient power lift controls, may permit the use of a single fertilizer attachment in connection with several different field operations. Such equipment, if sufficiently flexible, can perhaps satisfy all of the different fertilizer placement requirements in many instances.

The development of universal fertilizer equipment for the tractor is underway in several respects: The fertilizer hoppers are located at either end of the tractor where connections can be made convenient to the soil working tools. One arrangement for widely spaced row crops consists of a hopper at each side of the tractor with the fertilizer delivery tubes attached to furrowing tools (either cultivator shovels or special shoes) which can be adjusted vertically and laterally thus permitting various placements of the fertilizer. Such attachments can be used to place the fertilizer as desired simultaneously with the use of other attached machinery including the application of fertilizer while preparing the seed bed, planting seed, transplanting seedlings, or cultivating the crop.

Another arrangement for a wide range of row spacings consists of a series of fertilizer dispensing units mounted above a universal tool bar which extends across the tractor at the front, middle, or rear. The universal tool bar may be either a single or two parallel bars on which the furrow openers or other soil working tools can be set in any position. The fertilizer can therefore be localized near the seed or plant for any reasonable spacing of the rows.

Other points about the tractor and attachments are: The availability of ample power to place the fertilizer deeper in the soil or as otherwise desired. The tractor and mountings are heavy enough to carry larger fertilizer hoppers and to form a stable unit. The provisions for mounting equipment in various positions on the tractor permit a high degree of versatility.

Equipment for Deep Placement

DEVELOPMENT of equipment for deep application of fertilizer at plowing depth or deeper is in progress on a rather extensive scale. There are several reasons for this development and the purposes differ somewhat for different conditions.

The desire of many farmers to increase the per acre quantities of fertilizer beyond the capacity of existing machines made it necessary to utilize supplementary methods. Locating a major part if not all of the unusually heavy fertilizer application at considerable depth in the soil was known to be a safeguard against the adverse effects of temporarily high salt concentrations. There was a belief that deep-placement would insure the presence of more adequate moisture during dry periods as well as

promote deeper and more extensive root development. Breaking of impervious and compacted layers of soil seemed necessary under certain conditions to permit deeper penetration of water and roots, and under these conditions the addition of lime and mineral plant food to the disturbed subsoil should produce complementary effects. The desire to prevent soluble materials from being carried to the soil surface with irrigation water under some practices and possibly other considerations contribute to the interest in deep fertilizer applications.

The types of deep placement equipment under development include the following: Fertilizer attachments for wheel type plows which place the fertilizer in a band on the bottom of each plow furrow; fertilizer attachments on different kinds of deep tillage cultivators which place the fertilizer in bands 15 to 20 inches apart at plow depth or deeper during seed bed preparation; attachments on subsoilers for placing lime and fertilizer in the disturbed subsoil; plows with an auxiliary share for separately turning a layer of soil below the usual plowing depth to which a fertilizer attachment has been added; fertilizer attachments and special furrowing tools mounted on tractors for deep placement either at planting or during cultivation. The various methods and equipment for deep application of fertilizer are undergoing extensive trials not only in research studies but

also in farm practice. The place which each method may occupy in future practices and the superiority of one type of machine over another are yet to be determined.

Fertilizer in Liquid Form

APPLICATION of fertilizer materials in liquid form is not a new practice in connection with established irrigation systems. The new developments are concerned with the application of liquid materials by means of equipment on field implements. The latter developments may be considered to be in the initial stage. Simple devices which consist essentially of a container and delivery tube with an adjustable metering clamp or valve depend entirely upon gravitational flow of the liquid.

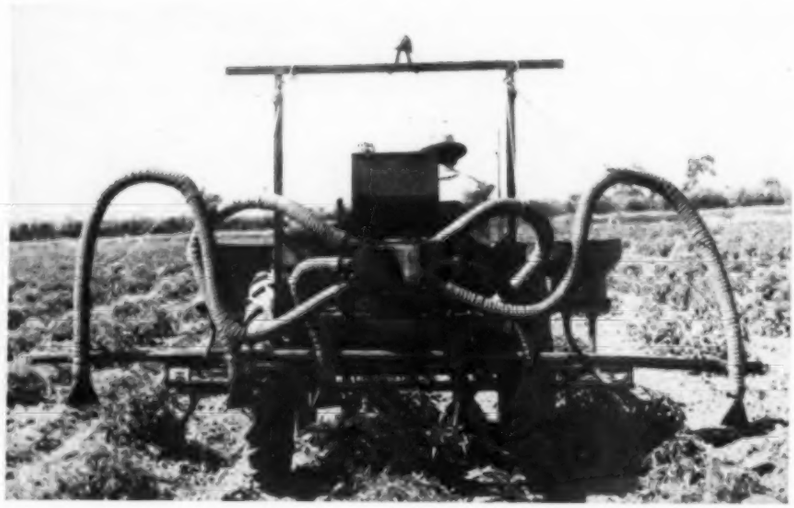
Liquid pumps of various types are being tried. In some cases the pump merely insures a constant flow of the liquid. In other cases the pump is used as a variable metering device which is driven by a ground wheel, thus its action varies with the speed of the machine and a uniform application on the land may be possible.

Specialized machines for applying liquid fertilizer materials at desired depths in the soil are also under development. One type of machine in use on a limited scale applies anhydrous ammonia. These machines are provided with metering devices and soil furrowing tools with suitable provisions for readily closing the furrows to minimize vapor losses.

This discussion does not cover the general problem and economic considerations of transporting and handling liquid fertilizers. In designing simple and inexpensive machinery to apply various liquids accurately at widely different rates including those containing sediment from dissolved mixtures, there appear to be a number of points to which the implement designer must give careful attention.

Broadcasting Equipment

BROADCASTING of fertilizer involves a large number of different kinds of machines among which certain developments may be of interest. The broadcasting of fertilizer on the soil surface immediately before plowing the land and broadcasting certain materials for small grain and legume crops affords some opportunity to make deliveries direct from storage to the land by means of transport trucks with spreading attachments. The time and labor of the farmer is saved with this system



Farm tractor fitted with fertilizer application equipment, and also insecticide dust applicator. Upper photo shows side view with hoppers and propelling mechanism for fertilizer on the front, and dusting apparatus at rear of machine. Lower picture shows same tractor from rear. Note how dusting pipes cover a considerable area. (Photos courtesy Ted Bull, Watsonville, Calif.)

but the ability to get delivery at the desired time or when the soil conditions are favorable for the operation of heavy trucks may be among the possible uncertainties. The use of this direct handling system has expanded but has not yet reached significant proportions in so far as fertilizers are concerned.

The broadcasting of fertilizer by airplane has recently increased. The use of airplane equipment is no longer confined to flooded rice fields but has been employed to top dress other crops particularly with nitrogen materials.

The potential use of the airplane may be greater than heretofore anticipated. The large acreage of crops which are top dressed, the vast acreage of pasture land and open ranges, forest land, and areas where conditions are not favorable for the operations of conventional implements offer possibilities for greater use of the airplane equipment.

According to the information received, one manufacturer alone has supplied spreading equipment for 1,000 airplanes. Although the equipment is intended mainly for spreading insecticides, the manufacturer also furnishes a fertilizer spreading attachment. Many of the fertilizer spreading attachments in use have been devised by the individual operators.

In the research studies with various inter-tilled row crops, broadcasting of the fertilizer has usually not been as effective a method as definitely placed localized applications. The broadcasting method, however, occupies an important place in farm practice because it is extensively used for applying fertilizer to such crops as pasture, hay, closely spaced row crops and fruit trees. The method is also used where a major part of heavy fertilizer applications is plowed under and under conditions where it is essential to maintain a high fertility level of the entire tilled layer of soil. If the philosophy of bringing the entire tilled layer of soil to a high state of productivity and maintaining the high fertility level is more generally accepted and found economically feasible, increased amounts of fertilizer may be applied broadcast or otherwise distributed throughout the soil.

The progress to date in using fertilizers more intelligently and efficiently has not only solved some of the urgent problems, but it has also increased the opportunities as well as broadened the field for further scientific discoveries, refinements, and improvements. The former simple procedures and practices of limited possibilties are giving way to exhaustive determinations and systematic control of fertilizer application and environmental conditions. This trend toward complete control leads to more exacting requirements for individual crops and local conditions.

From the engineering standpoint these progressive scientific changes along with the use of physically different fertilizer materials and divergent field conditions and practices, require careful consideration in

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Technical and Commercial Aspects of

2,4-D

By L. W. Kephart*

Senior Agronomist, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

RECENT discovery of the weed-killing properties of the growth-regulating substance 2,4-D, has created unprecedented interest in weeds and weed control on the part both of the public and of the chemical industry. The result is an insistent demand for information, and the demand is difficult to satisfy. Discovery of this extraordinary herbicide took everyone by surprise. Whether fortunately or otherwise, the development came just at the time when many chemical companies with war-expanded facilities were beginning to look for new products to sell. Weed killers based on 2,4-D were easy to make and seemed to offer fine possibilities. As a result, many chemical companies that had never been in the agricultural field before came into the market with a product for which they had no previous background of experience. Scores of inquiries came to the Department of Agriculture from chemical manufacturers, the majority of whom stated frankly that they knew little or nothing about weed control and still less about the potential demand for weed-killing chemicals. The principal thing that most inquirers wanted to know was "How much of a market will I have for this product, and how long will the demand last."

It may be assumed from this that the question uppermost in the minds of those who recently have gone into the herbicide business is "Should I make a weed-killer or something else?" For the sake of their potential customers and of their own businesses, not to mention the peace of mind of the Department of Agriculture and the State Agricultural experiment station, attention should be given some of the factors that influence the demand for, and the marketability of, weed-destroying chemicals.

Of first importance is an understanding of the part that weeds play in the agricultural economy. Are weeds merely an annoying nuisance or are they something that farmers will pay money to combat? Weeds were probably one of the original tribulations of man. The first man who cultivated soil undoubtedly had weeds to contend with and his successors have had them ever since. Yet, strangely, weed control is one of the last great problems involved in agricultural production to receive the attention of biological science. Other pest problems, such as insects, rodents, and plant and animal diseases, have been subjected for more than a hundred years to the scrutinizing eyes of scientists. In the United States alone, for a quarter century or more, there have been constantly on public and private payrolls more than a thousand professional entomologists devoting their entire time to intensive studies of the life histories, habits, and control of insects.

During the same period, nearly a thousand plant pathologists, several hundred animal pathologists, and scores of specialists in divers other kinds of pest control have been busily engaged in research on those problems. Yet there were, in the United States, as recently as 15 years ago only three fulltime weed control specialists. In 1930, our knowledge of insect and disease control was already enormous; our knowledge of weed control was elementary. For all practical purposes, in 1930 we knew scarcely more about weed control than had been known to every good farmer for centuries. Today, the situation is much better. Thanks to the efforts of a few insistent pioneers, there are now more than 100 fulltime weed specialists at work. Knowledge is piling up rapidly. It is amazing that, starting from this dead level of ignorance 15 years ago, we have come so far in so short a time. The next 15 years should see even greater progress. In this progress, herbicides will have an important part. Hence, it seems safe to predict that the future of the chemical weed-killer business is comparatively bright.

There are, however, certain pitfalls along the way. The market for weed killers is not wide open for everyone who wants to sell a patent nostrum which *he thinks* will work. The requirements are much more severe than that. Only those who have a truly superior product can hope to sell to farmers who are most critical buyers. Then too, there are, or soon will be, many State and National herbicide labeling laws which must be considered. Competition in the industry will be intense. The job will be in the hands of highly trained experts in that particular field.

* Address delivered at the meeting of the National Association of Insecticide and Disinfectant Manufacturers, Inc., Chicago, Ill., June 9, 1947.

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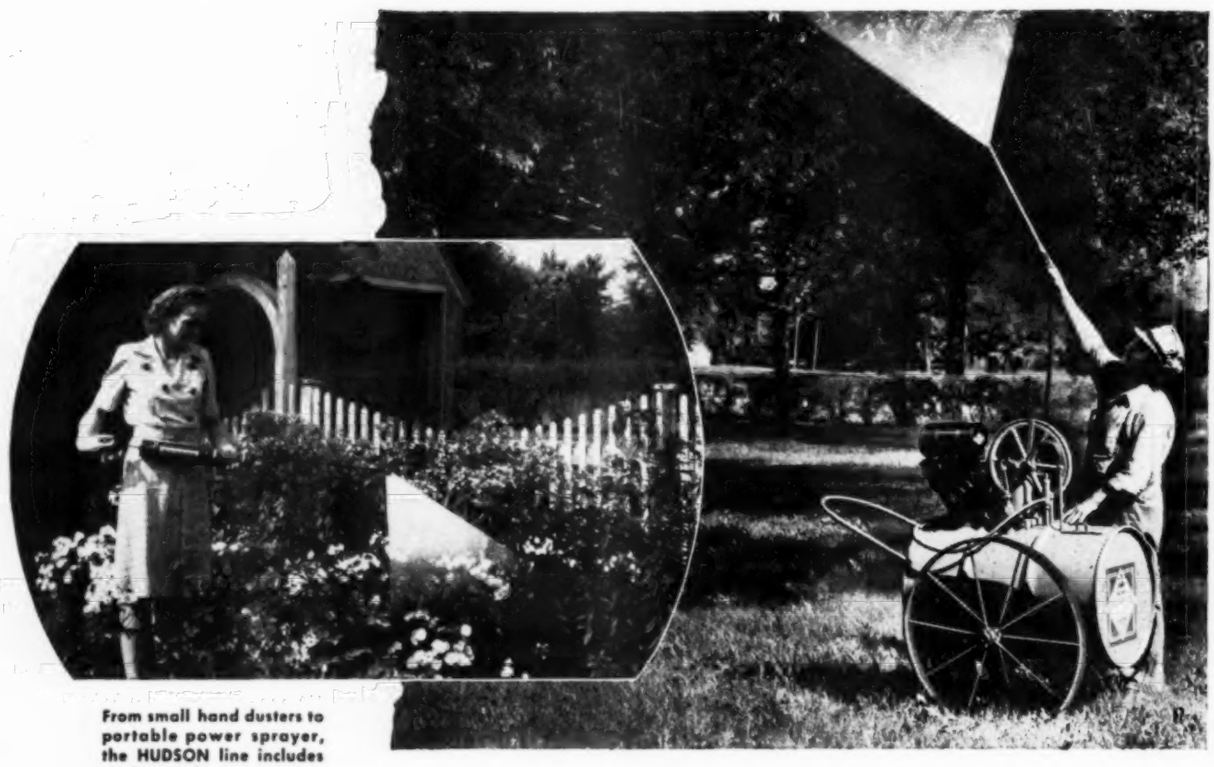

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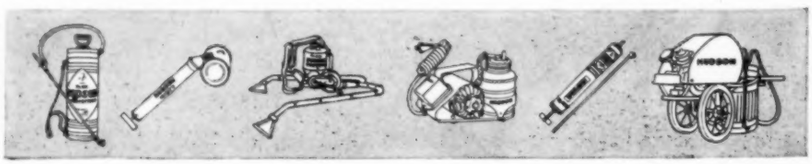

Obviously, there is no place for amateurs.

Annual Weed Toll Heavy

WEEDS are probably the most destructive of all the kinds of agricultural pests. This is hard to believe when one thinks of the enormous and highly publicized losses caused by insects, plant diseases and rodents. Perhaps the easiest way to visualize the relative damage caused by weeds is to imagine one's self driving across the United States in a straight line in any direction. Suppose that the farmer at every tenth farm house was asked, "How much time and how much money did insects cost you last year? How about diseases? How about weeds?" Through the cotton belt and in fruit-growing regions, every farm would probably have had trouble with insects during the year, but in the great corn belt, in the wheat country, and in most general farming areas everywhere, only an occasional individual would have been materially troubled by insect depredations. The same would be true of damage from plant diseases—some farmers would have found them costly, but most would have had no difficulty. But when the farmers were asked about weeds it would be found that every farmer, regardless of his location or the kinds of crops that he grew, had had trouble with weeds on every foot of cultivated soil and he had the trouble every year. It is estimated that losses due to weeds, either direct or indirect, amount to 10 percent per year of the value of all agricultural production. Only soil erosion has a more crippling record in our agricultural history. The very enormity of the problem has blinded up to its seriousness. Long ago, it seems, we resigned ourselves to the inevitable.

Now, almost over night, this somber picture has changed. Suddenly we do have the means of doing something about this enormous loss. With 2,4-D many kinds of weed control may be accomplished that were formerly thought impossible. The question now is how far we may expect to go.

The first thing to keep in mind in trying to estimate the quantity of 2,4-D or other chemicals likely to be used in weed control is that chemicals will always be in competition with other and simpler methods. Remember that the farmer always has a mowing machine, a plow, and a harrow handy and he knows how to use them. Perhaps these implements might not do quite as good a job as the herbicide would do, but they answer reasonably well and they cost the farmer nothing extra except his own time and a little tractor fuel. Farmers will not buy herbicides unless the chemicals are sure to do a better job than can be done with their mechanical equipment. They will discover that special equipment must be used for applying chemicals. They will remember also that a mowing machine is almost fool-proof. They will learn too that the chemicals themselves, even the best of them, are not completely dependable, but fail at times for reasons that cannot be explained. Thus, when the first flush of enthusiasm for this seemingly miraculous method has cooled, the farmers are going to think twice before buying weed killers in large quantities.

Also, it must not be forgotten that weed research people are working on other methods of weed control in addition to herbicides. Much effort is directed toward the development of better kinds of crop rotations, of tillage and cropping methods that will keep down weeds incidentally in the course of the regular farm operations and with no additional expense. This is the ideal method of weed control and no farmer who can handle his weeds in this sensible way is going to bother with herbicides.

In some of the more flamboyant advertisements of the new chemical weed killers, it has been indicated that a single application of this wonder-working material will rid the farm forever of weed difficulties. This is a very unfortunate promise to make for it cannot possibly be fulfilled. No herbicide will rid a farm of weeds in one year, or even after many years. Every cultivated soil on earth contains within each cubic foot some thousands of seeds of various kinds of weeds. These seeds are able to live in the soil, with their viability unimpaired, for as long as 5, 10, 20, or even 40 years. They do not germinate until brought close to the surface of the soil, under favorable conditions of heat and moisture. This is nature's way of insuring that the soil will always be protected with a vegetative cover. It would be catastrophic if we tried to upset this very wise provision. Even if a chemical could be found that would kill every weed seed in the soil, it is doubtful if responsible authorities would permit its use, for our soil erosion difficulties are bad enough as it is. Thus, the best that the seller of herbicides can promise is that his material may eliminate weed troubles for the current year.

Reason for Optimism

ALTHOUGH the doleful side of the picture looks rather dark, there is a brighter side to compensate. Granting that there will not be enough herbicides sold to treat all of the 360,000,000 weedy acres in the Nation, what portion may be reasonably expected to be treated?

Five years ago 1,000,000 acres was thought to be the absolute outside limit of the area of farm land upon which herbicides could be used profitably. Today it seems likely that that figure may some day be increased a hundred times. It is not at all beyond the bounds of reason to think that before long herbicides will be used on about one-fourth of the small grains, one-half of the sugar beets and sugar cane, most of the grass seed producing areas, some of the pastures and ranges, and part of the commercial vegetable area. There is more than a possibility that to this may be added a considerable part of the corn acreage. If railroad rights-of-way, roadsides, and miscellaneous areas are included, the figure of 100,000,000 acres is not an unreasonable expectation. Translated into terms of 2,4-D, this amounts to an annual usage of about 50,000 tons.

This does not necessarily mean that we will be selling 2,4-D in such quantities next year, or ever. Part

(*Turn to Page* 59)

Particle - Size Reduction of DDT in grinding with diluents

Tests show that although variation exists, grinding DDT with diluents does give considerable reduction in particle size of the insecticide.

IN specifications for 10 percent DDT dusts the two tests commonly used are a dry sieve test and the determination of surface mean diameter by air permeation. Neither of these tests yields much information as to the particle size or particle size distribution of the DDT itself in the mixture. This knowledge is desirable because of the continuing tendency toward ever finer particle size of dusts used as insecticides. It was thought that wet sieve analyses of the DDT itself and of dusts prepared from it, with subsequent analyses for DDT of the fraction retained by each sieve, would yield significant information about the particle size of the DDT resulting from grinding it with various diluents.

Experimental

A series of twelve DDT tests was prepared by mixing 20 grams of technical grade DDT with 180 grams of diluent and grinding the mixtures in a laboratory-model hammer mill. All but two of these diluents are commonly used as insecticide carriers, and their physical characteristics are given in Table 1. The physical characteristics of the finished powders are shown in Table 2.

The wet sieve test was performed by suspending a 50-gram sample in 1 liter of water containing 1 percent of a wetting agent ("Vatsol IB"), pouring the suspension through the finest sieve (U. S. No. 325), and continuing to wash through the sieve with a spray of tap water until no more material went through the sieve. When the amount of material retained by the No. 325 sieve seemed to warrant it, the wet sieving was repeated with another 50-gram sample through the next finest sieve, and so on until a sieve was reached which retained little or none of the sample. The fractions retained by the respective sieves were analyzed for DDT content. The results of the sieve tests of the 10 percent DDT dusts appear in Table 3. Table 4 gives the percentages of unground and of ground DDT passed by the various sieves.

Discussion

1. From the sieve analysis of the unground DDT, computation shows that its surface mean diameter lies between 200 and 300 microns, with

TABLE 1.
Physical Characteristics of Diluents

Diluent	Source	S.M.D.[1] microns	Bulk density[2] g/cc	Sp. Gr.	Dry Sieve	
					Percent through No. 100	Percent through No. 325
Magnesol	Synthetic magnesium silicate	0.4	0.16	2.07	99	10
Tricalcium phosphate	Chemical reagent	4.1	0.68	3.14	100	12
Pyrax ABB	North Carolina pyrophyllite	3.5	0.49	2.73	100	73
Attaclay	Georgia fuller's earth	1.9	0.29	2.59	99	47
Diluex	Florida fuller's earth	1.7	0.30	2.35	100	61
Homer clay	Georgia	1.0	0.25	2.67	82	6
Talc	Vermont	3.8	0.54	3.05	100	98
Topton clay	Pennsylvania	1.0	0.23	2.68	82	18
Sheridan 6 clay	Tennessee	2.5	0.53	2.61	100	71
Brunswick clay	New Jersey	1.3	0.33	2.54	100	12
Cherokee clay	Georgia	1.1	0.32	2.67	100	6
Type 41 kaolin	South Carolina	0.6	0.21	2.58	97	4

[1] Surface mean diameter by air permeation. [2] By Scott volumeter.

* This research was conducted as part of a program supported by transfer of funds from the Office of the Quartermaster General, U. S. Army, to the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

by

J. Weisser and
E. L. Gooden

TABLE 2.
Physical Characteristics of 10 Percent Dusts

Diluent	S.M.D. microns	Bulk density g/cc	Sp. Gr.	Dry Sieve		
				Percent through No. 60	Percent through No. 120	Percent through No. 230
Magnesol	1.5	0.14	2.02	99	83	13
Tricalcium phosphate	4.1	0.63	2.86	100	99	68
Pyrax ABB	4.3	0.35	2.55	100	99	93
Attaclay	1.6	0.21	2.43	100	95	22
Diluex	1.6	0.24	2.24	100	99	63
Homer clay	1.2	0.24	2.51	99	54	2
Talc	4.1	0.37	2.79	99	97	32
Topton clay	1.2	0.19	2.51	99	25	2
Sheridan 6 clay	1.7	0.36	2.46	99	98	57
Brunswick clay	1.0	0.22	2.40	100	72	4
Cherokee clay	1.1	0.27	2.51	99	75	7
Type 41 kaolin	0.7	0.17	2.43	89	55	3

TABLE 3.
Wet-Sieve Analyses of 10 Percent DDT Dusts

Diluent	Sieve No.	Percent retained	Percent DDT in fraction	Percent DDT of original
Magnesol	120	0.18	—	—
	230	1.30	29.1	3.8
	325	3.60	7.3	2.6
Tricalcium phosphate	60	0.16	6.2	0.1
	120	0.60	66.0	4.0
	230	3.86	31.1	12.0
	325	16.24	7.8	12.7
Pyrax ABB	120	0.90	62.2	5.1
	230	5.36	24.9	13.3
	325	16.16	16.0	25.4
Attaclay	120	0.38	81.5	3.1
	230	5.32	22.3	11.9
	325	15.42	15.3	23.6
Diluex	120	0.24	91.2	2.2
	230	1.24	40.6	5.0
	325	6.44	19.5	12.6
Homer clay	120	0.28	96.2	2.7
	230	0.62	93.6	5.5
	325	1.42	84.4	12.0
Talc	120	0.70	92.8	6.5
	230	2.10	91.0	19.1
	325	3.92	69.0	27.0
Topton clay	325	3.44	46.2	15.9
Sheridan 6 clay	325	4.30	65.4	28.1
Brunswick clay	325	3.80	24.2	9.2
Cherokee clay	325	2.12	84.4	17.9
Type 41 kaolin	325	2.10	75.0	16.5

250 microns as the best round-number estimate (all calculations without shape factor).

2. Unground, the DDT passed less than 2 percent through a U. S. No. 325 sieve. Ground, the DDT passed 72-97 percent through the same sieve.

3. For the unground DDT the "mass median" sieve diameter is more than 500 microns—a fair estimate is 600 microns; for the ground DDT it is well under 44 microns—probably below 30 microns.

The term "mass median diameter" as here used and proposed designates the diameter that is the boundary between the coarser half and the finer half of the sample by weight (mass). Accordingly the mass median sieve diameter is the mass median diameter as measured by sieves, without the application of a shape factor.

4. For the unground DDT the surface mean sieve diameter is approximately 250 microns, whereas for the ground DDT it is well under 44 microns, probably of the order of 10 microns.

5. The most effective grinding was obtained with a synthetic magnesium silicate, the least effective with a Tennessee clay. Three other diluents among the less effective in reducing the particle size of the DDT were a North Carolina pyrophyllite, a Vermont talc, and a Georgia fuller's earth.

Summary

A method is described for obtaining some measure of the particle-size reduction of DDT on grinding with diluents. The method has been applied to a series of twelve diluents, ten of which are commonly used as carriers for insecticidal materials. While the results show great variability from one diluent to another, they show also that all the diluents studied give considerable reduction in particle size of the DDT. A statistical term, "mass median diameter," thought to be new, is proposed and defined.

TABLE 4.
Percentage of DDT Passing Indicated Sieves Before and After Grinding with Diluents

Sieve U. S. No.	35	60	120	230	325
Sieve opening, microns	500	250	125	62	44
Unground DDT	40.4	24.9	13.9	6.1	1.4
Magnesol				96.2	97.4
Tricalcium phosphate		99.9	96.0	88.0	87.3
Pyrax ABB			94.9	86.7	74.6
Attaclay			96.9	88.1	76.4
Diluex			97.8	95.0	87.4
Homer clay			97.3	94.5	88.0
Talc			93.5	80.9	73.0
Topton clay					84.1
Sheridan 6 clay					71.9
Brunswick clay					90.8
Cherokee clay					82.1
Type 41 kaolin					83.5

Comparison of Some Volatile SOIL FUMIGANTS

CARBON disulfide and Formaldehyde have been known for half a century to have insecticidal and fungicidal properties useful in combatting soil pests. But with the development about fifteen years ago of chloropicrin, which combines both capacities together with ability to kill weed seeds, a great impetus was given to the search for cheap, volatile soil fumigants. In the past ten years more progress along this line has been made than in fifty years preceding, so that Dr. Robert M. Salter, chief of the Bureau of Plant Industry, is said to have remarked that "new soil fumigants bid fair to become one of the greatest boons to agriculture since the development of fertilizer." This is an arresting statement. It is based on the performance of one or two recently developed inexpensive soil fumigants which have remarkable capacities to kill nematodes, wireworms and some other insects, even when used at dosage rates as low as 20 to 40 gallons —200 to 400 pounds—per acre.

Florists, vegetable growers and home gardeners are naturally asking where do these soil fumigants fit into their picture. Comparative tests of the better known fumigants have been made for the past decade in many parts of the country. Some of the good features and limitations of those being offered currently for sale are coming more clearly into view although much testing remains to be done. The writer's experience is limited to conditions prevailing in the northeastern parts of the United States where all soil fumigants are thought of as substitutes for steam, having the virtues of being both cheaper and more convenient.

So far no fumigant will do all that steam will, nor do it more effectively. The cheaper ones are primarily nemacides and insecticides. Since large areas of otherwise very productive land in the South, on the West Coast, and in Hawaii are infested with root knot nematode, beet nematode, or wireworms, fumigants which are doing a fine job of controlling these pests are being heralded as great boons to agriculture. To the florist and greenhouse vegetable grower who has steam available they may offer an easier, quicker, and usually much cheaper way to control nematodes, but except for chloropicrin, and to a limited extent methyl bromide, they offer little or no help in controlling damping-off root rots, and wilt producing fungi. Inability to control soil-borne fungi is the great weakness of the majority of them. Chloropicrin can do this, but it has other shortcomings.

The Ideal Soil Fumigant

THE ideal soil fumigant has not been found. It should, like steam, kill all pests, leave the soil quickly, be non-injurious to foliage, non-corrosive to the container, harmless to the operator, should need no seal, and be inexpensive. As measured by these standards, chloropicrin sold as "Larvacide" is the only one that comes near killing nematodes, fungi, weed seeds and insects. To do all this it must be used at dosage rates that make it as expensive as steam. It is very toxic to foliage, and very disagreeable to handle, is hard on the machinery used in dispensing it, and must be sealed in and then induced to escape completely before planting can be safely undertaken. While chloropicrin is especially effective in killing certain fungi, as Fusarium and Verticillium, the damping off organisms, and most weed seeds, it is not so reliable against the one producing Sclerotial resting bodies such as Sclerotinia and Botrytis unless very high dosage rates are employed or special confinement provided.

Common dosage rates for root knot control in ground beds and bench soil are from 1½ to 3 ml. on 10 to 12 inch centers or if applied by continuous drip apparatus from 300 to 600 lbs. per acre. For compost soils where it is important to kill weed seeds, the dosages recommended are 7 to 10 ml. per cu. ft. or ¾ to 1 pound per cubic yard.

Methyl Bromide

NEXT to chloropicrin in efficiency and expense come the two methyl-bromide containing mixtures marketed as "Iscobrome" and "Dowfume G." These contain respectively 15 and 10 percent, by volume, of active fumigant dissolved in cheap, harmless, nearly odorless, solvents.

Their development marked a step forward in several respects. They are not phytocidal and so can be used within a foot or two of most plants. They will penetrate unrotted root galls very quickly, in two or three hours, and leave the soil in a few days ready to be sown or planted. They are not at all disagreeable to handle, being relatively odorless, although methyl bromide is dangerous and plenty of ventilation is required for safety of the operator. These are the only fumigants that can be recommended for winter use in northern greenhouses when soil temperatures are below 65° and the grower wishes

By

Professor A. G. Newhall

Department of Plant Pathology
Cornell University, Ithaca, N. Y.

to replant in less than ten days. Being non-corrosive they can be used more easily in several of the dispensers on the market. They are perhaps 30 percent less expensive than chloropicrin as employed against nematodes.

While their principal use as soil fumigants is in destroying root knot nematode and several insects, they can be employed, like chloropicrin, at greatly increased dosage rates (5 times) to control damping off organisms, most weed seeds, and even the sclerotia of Scherotinia and Botrytis, provided the soil to be treated is in a gas-tight drum or under a gas-proof cover. Even under these conditions they may not be as effective as chloropicrin against the Fusaria. Being more volatile than any other soil fumigant on the market, a water or other seal must be promptly applied when they are used on open beds. There is some evidence that the dosage rate against nematodes, as commonly given for soils at temperatures above 70° F., should be increased when the temperature is down to 50 or 55° in bed or bench soil. At the ordinary dosage rates employed for root knot, 4 to 7 ml. on 10 inch centers, 15 to 30 pounds per 1000 square feet, (or 500 to 1200 lbs. per acre), the methyl bromide fumigants are not very good fungicides or herbicides. They are at their best when applied with hand injectors, where the hole is immediately stepped on, rather than with continuous flow subsurface dispensers. Damping off and weed seeds have recently been controlled in compost soils held in tight drums by application of 11 ml. of straight methyl bromide per cu. ft. or by 50 ml. of either "Iscobrome" or "Dowfume G." Success can be attained even at soil temperatures near 50° F. A device for metering liquid methyl bromide out of cylinders is now available at less than $25.

"DD" Mixture

DISCOVERED by Carter about 1941 in Hawaii, where it is currently being applied to much of the pineapple acreage for eelworm and insect control, this by-product of the petroleum industry is named after its two principal constituents, 1, 2 dichloropropane and 1, 3 dichloropropylene. Like DDT, it received an unprecedented amount of testing during the war so that most of its good and bad points are fairly well known.

In the first place, it presents a very much cheaper control of root knot nematodes and wireworms than either chloropicrin or methyl bromide. It will penetrate unrotted galls in less than 24 hours. It performs well even without any water or other seal following its application. If soil has been moistened a few days before application is made, it will kill some weed seeds, though it is not reported to be as good as chloropicrin in this respect. "DD" mixture is not a lacrymator, but it is rather disagreeable and the green house operator needs plenty of ventilation. It is less corrosive than chloropicrin but will attack iron in the presence of moisture and thus result in sludge accumulation in open containers. It is not a good fungicide against common soil-borne pathogens, according to several reports, even at dosage rates up to half a ton to the acre, and so has rather limited usefulness for many florists. However it has been recently reported to have given control of bacterial wilt of tobacco which lasted into the second year when used at 900 lbs. per acre. It remains in the soil as long as chloropicrin, if not longer, because of its somewhat higher boiling point which limits its use to summer time, or to soils that are either up to 70° or are not needed for replanting for two to four weeks, depending on the temperature and rainfall. Tomato plants have been set in greenhouses in ten to fourteen days when soil temperature was up to 70° F. without loss. There is little question about injury to certain flowers from winter applications to soils in greenhouses if no ventilation is practiced at night. Also excessive applications followed by frequent rains have been known to impart a flavor to carrots grown on treated land. This is believed to be due to certain extraneous impurities. Very large quantities are being used annually in parts of the country where wireworms and nematodes are a big problem and its future looks bright. Common dosage rates are 20 to 40 gallons per acre (approximately 200 to 500 lbs.).

Ethylene dibromide

THE latest rivals of "DD" are certain products containing the odorless, non-flammable, non-corrosive, volatile hydrocarbon, ethylene dibromide. It acts so efficiently against nematodes that .1 cu. cm. or 1/300 ounce is enough to eradicate them from a gallon of soil. It is being put on the market this year under the names of "Iscobrome D" containing 10 percent of active ingredient in a suitable solvent, "Dowfume W-40" containing 20 percent, and "Garden Dowfume" containing 5 percent. Perfect cotnrol of root knot nematode has been obtained in our experiments with 12 pounds of a 10 percent product on 1000 square feet at a cost of about $2.00. Like "DD" these fumigants are used mainly for the control of nematodes and wireworm or other soil insects, and cannot be depended upon to kill weed seeds or fungi, but they are among the lowest in cost, the easiest and safest to handle of any of the soil fumigants yet developed. What was said about persistence of "DD" in the soil also applies with as much or more emphasis to ethylene dibromide which has a boiling point 20° higher than chloropicrin. However it has less tendency to impart bad flavor to carrots. It is not recommended for greenhouse use in wintertime if soil temperatures are below 70° and replanting in less than two weeks is desired. Large quantities are being used for wireworms and nematodes on the west coast where dosage rates are 10 to 20 gallons of a 20% preparation. Its future looks bright.

(*Turn to Page* 63)

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Use of CHEMICALS in Florida's GLADIOLI INDUSTRY

by

E. G. Thomssen, Ph D.

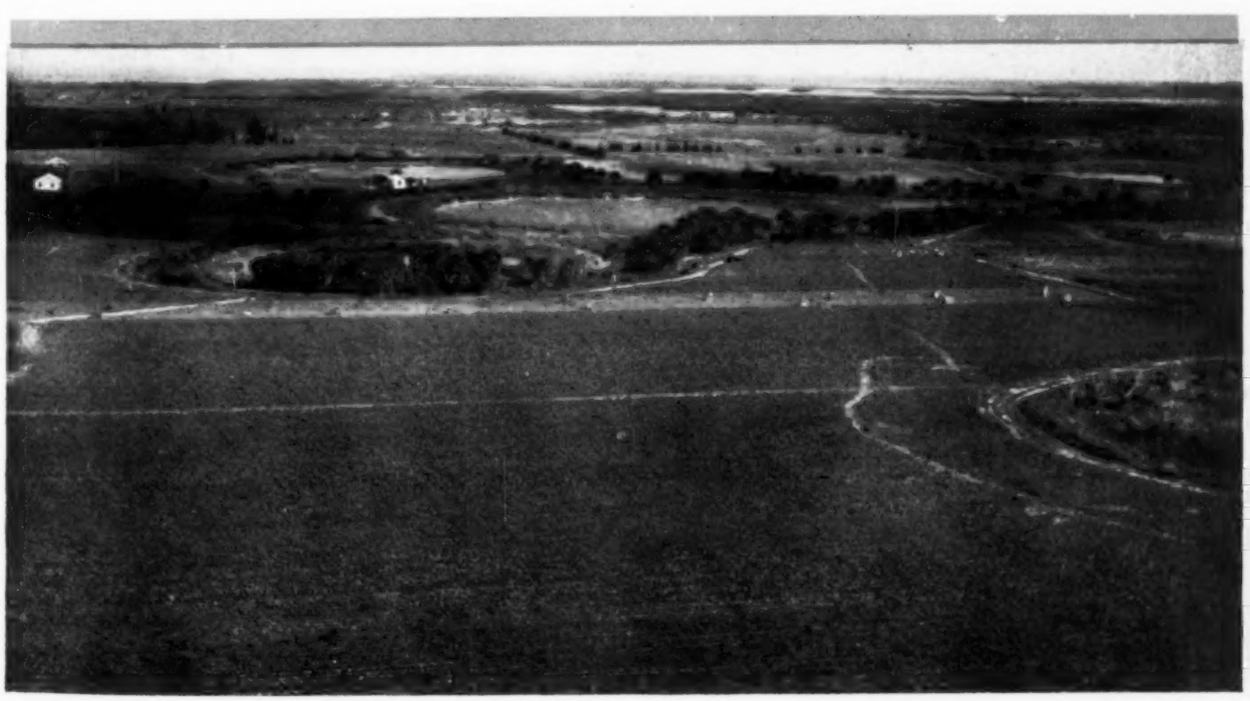
THE cultivation of gladioli for flowers and bulbs has grown into a large agricultural crop in Florida. From small beginnings in the early thirties the industry has grown into an annual crop worth millions of dollars. It is claimed that practically all the gladioli sold by florists east of the Mississippi from November or killing frost time, through April, are raised in Florida.

The growing of "glads" for florists is said to have originated around Clearwater. Its possibilities for large acreage were first recognized by certain Dutchmen who settled in that locality and had grown bulbs in Holland. Spreading from that area which is somewhat more susceptible to frost damage than farther south, other sections of Florida have been opened. Large fields are now found at Delray Beach and Fort Pierce on the Florida East Coast, but on the West Coast the industry is more extensive. The main area extends close to the Gulf Southward from Clearwater down to Fort Myers. The main towns include Clearwater, Sun City, Bradenton, Murdock and Fort Myers. The industry had its most prosperous year in 1945-46 when growing conditions were good and flower prices were high.

Up to recent years the bulbs were practically all imported from the states to the North. Some also were imported from Central America. As is known, it takes three to four years to produce a satisfactory bulb that will in turn produce big spikes. It was believed that states like North Carolina, Connecticut, Illinois and Georgia could produce suitable bulbs more cheaply than Florida. When the cost of bulbs greatly increased, however, the Florida growers began producing their own bulbs. This end of the business is constantly being given more attention with satisfactory results.

As the industry expanded, a Gladioli Growers Association was formed with headquarters in Sarasota. Most of the growers are members of this Association whose purpose it is to promote the welfare of its members in many ways. One of its main activities has been to persuade the State Legislature to delegate a plant pathologist to devote his entire time to research on the proper growing methods for gladioli, and insect and disease control. In recent years the headquarters of these experiments have been at the Florida Vegetable Crops Laboratory in East Bradenton. An annual state grant supports the

Tons of various chemicals are needed to protect and fertilize vast gladioli fields of Florida. Below: air view of large acreage devoted to growth of flowers.



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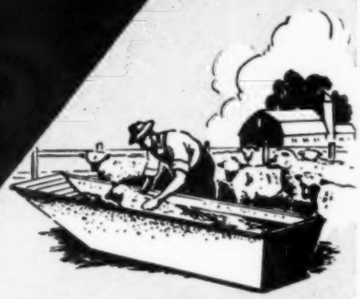

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work and much progress has been made toward the proper fertilization, control of insects, disease eradication and selection of proper varieties.

In the growing of glads the actual planting season in Florida begins in mid-July but the heaviest plantings are made from mid-August to mid-September. The single biggest variety of flower grown is the Picardy, a salmon pink bloom, which is quite disease resistant. It is the aim of the growers to furnish flowers from northern killing frost time to about May 1st. All spikes are sorted as to sizes, seven in all and are shipped in bud form. It takes the spikes about a week to open after shipping.

The main problems in growing gladioli are weather, fertilization, insects and diseases mainly due to fungi. These are present from the time the bulbs are dug until the spikes reach the florist in the North.

The climate in the localities where gladioli are grown is generally favorable. Since rotation of crop is desirable, new areas are opened from time to time. Often these are away from reasonably frost proof sections. During February of 1947, when Florida had some of the coldest weather on record, this procedure was costly. One grower put out many acres upon land that was purchased cheaply in a new region. When the freeze came the losses were in the hundreds of thousands of dollars in a single night as the cost of growing glads runs close to $2,000 an acre. Some raisers resort to firing and smudging, but this is not general.

The fertilization of the plants is carried on with varying amounts of usually 4-7-5 fertilizer per acre. It is applied by bands before planting and as a side dressing. After two years of testing by the Florida Vegetable Crops Laboratory, it has been found after applying 600, 1200 and 2400 pounds per acre that 1200 lbs. per acre is quite generally satisfactory. Work is also being done on the pH of the soil and improvements in yields and quality are to be expected when these investigations are completed.

The control of insects infesting gladioli is not as difficult as the control of fungi. Thrips are the main

Dipping gladioli bulbs in "Ceresan" to protect from fusarium. Process consists of soaking bag of bulbs for fifteen minutes.

insect attacking them. Up to recent years these were controlled by spraying as they appeared with a solution of tartar emetic and sugar in water. This control method has been replaced recently with DDT spray or dust. The spray is made with two pounds of DDT, 50% wettable DDT in 100 gallons of water to which is added 8 ounces of spreader sticker. The dust consists of 3% DDT in "Pyrax." One spraying with DDT is claimed to be better than three of tartar emetic. Bi-weekly applications are necessary as against weekly applications of tartar emetic spray. The advantage of using DDT is that it also controls other insects like leaf hoppers and chewing larvae.

Disease control is very necessary to proper cultivation. One of the most destructive of these is termed bulb rot, corn rot and Picardy rot by the growers. The more accurate term is fusarium brown rot. This disease may cause complete ruination of a field unless proper precautions are taken. The disease once started on susceptible bulbs progresses rapidly and produces total loss in a few years unless corrected. The Picardy type is affected readily by this fungus. It is not to be confused with fusarium yellows or core rot.

Various types of treatments to control fusarium were tried but new improved "Ceresan" (ethyl mercury phosphate) is most generally used to treat the bulbs and bulblets. The process devised by Dr. D. B. Creager,[1] consists of soaking the bulbs enclosed in burlap bags for fifteen minutes in one-half a pound "Ceresan" in 25 gallons of water and five tablespoons of spreader sticker or suitable wetting agent. Dr. Robert O. Magie[2] recently reported that increasing the amount of spreader-sticker on certain varieties of glads increased the value of spikes by 30% and that a ten second dip in a double strength "Ceresan" solution plus 10 tablespoons of "Triton X100" gave a 33% increase in value over the usual method. He furthermore has found that a ten second dip in "Merthiolate" 1000 to 2000 solution had about twice the value of treating flowers by the standard method.

"Lysol" is also used to a limited extent for controlling fusarium rot, where "Ceresan" is not easily obtainable. Since corrosive sublimate treatment, often recommended for treatment, injures the bulbs it is not used any longer.

Many other diseases are encountered by glad growers. They find these diseases are most prevalent after rains. Even overhead irrigation is not advisable for once fungi or virus enter the bulb neck they are most harmful. Among these are leaf blight, dry rot, penicillium rot, yellows, mosaic, leaf spots and botrytis. While all cause damage to a greater or lesser degree depending upon conditions, botrytis has concerned Florida glad growers

(*Turn to Page* 58)

1 "Treatment of Gladiolus Bulbs," Florist Review, March 2, 1944.
2 Bulletin issued by Veg. Crop Lab., Sept. 12, 1946.

FOR ANIMAL SPRAYS AND DUSTS

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Kill the parasites that are here now

Kill the ones that come along later

Kill still others before they can start

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NITROGEN...

World Production and Distribution Expands To Meet Increased Use

by

Wilson T. Hart*

Chemical Division, Office of Materials Distribution
U. S. Department of Commerce

BECAUSE there is such a tremendous over-all shortage of nitrogen, it seems that the eyes of the world are focused on this element of plant food. It is a well-established fact that the production of practically every type of nitrogen has increased materially in some sections of the world but it is equally as true that in other sections, production has been reduced and in some instances completely shut-off. Germany, normally a nitrogen exporting nation, is now importing over 100,000 metric tons of "N." The United States has increased production of practically all types with the possible exception of sodium nitrate which is due largely to inability to secure sufficient quantities of soda ash which is another critical material.

Without going back too far, a comparison of the past years performances with this year will help to forecast the production for 1947-48. The prewar world production from 1936 through 1938 was 2,242,000 metric tons of pure "N." The 1946-47 estimated production amounts to 2,555,000 metric tons, or an increase of 113,000 tons. This net increase does not seem so large but remember that many of the producing countries are now devoid of nitrogen producing plants. Production in North America is the bright spot in the picture. Canada and the United States produced during the years immediately preceding the war about 254,000 tons of "N." The production in 1946-47 is approximately 791,000 tons, or an increase of about 537,000 tons. Europe at one time was the chief producer of nitrogen, but now North America is ahead. General production in Europe is down from a three-year average for 1936-38 of 677,000 metric tons of "N" to 318,000 metric tons. The need for nitrates in Europe, China and India has greatly increased over-prewar needs. Japan requires about 380,000 tons and Southern Korea 63,000 tons. To add this up, there is a world shortage of at least a million tons and it has been estimated as high as two million tons for 1947-48.

Regarding nitrogen in the U. S., the principal trouble lies in mal-distribution. Farmers in the North Central States area normally use no fertilizers, but due to the pressure to increase their crop yields, did use fertilizers for the first time during the war. The results were so spectacular that the state of Iowa alone increased its consumption from 9,000 tons to 215,000 tons of fertilizers per annum. Some complaints have come in from the South where nitrogen is badly needed for top and side dressing. However, a look at the States from which these complaints originate shows that the consumption of fertilizers has nearly doubled over the five year pre-war average. In the state of Mississippi, for instance, 285,000 tons of fertilizers were consumed during the pre-war years. The total consumption in 1946-47 was 477,000 tons. The state of Georgia increased its consumption from 725,000 tons of fertilizer to over a million tons in that same period.

However, it is not necessary to dwell too much on the domestic picture, for the trade is fully aware of what has been accomplished. It may be enlightening, however, to give a comparative figure on the production of nitrogen in 1946-47 with the estimated production for 1947-48. From July 1, 1946 to May 1, 1947,

* As presented at the June, 1947 Annual Convention, The National Fertilizer Association, Spring Lake Beach, N. J.

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Legislative Service . . .

THE legislative season for 1947 is about over, but . . . .

Eighty-one supplement sheets to the AIF Law Guide, a part of the AIF legislative service, were required to record and analyze changes in State laws.

This is part of the flow of information which makes AIF membership a profitable investment.

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a period of ten months, solid nitrogenous material produced in the United States amounted to 373,000 short tons of "N" as against 333,000 tons for the same period last year or an increase of 40,000 short tons of "N." Solutions for the same ten months of this year showed a production of 175,000 short tons of "N" as against 146,000 tons for the same period in 1945-46, an increase of approximately 29,000 tons. U. S. imports, however, for that same period show a decrease. Whereas the ten months period previously referred to showed this year's imports amounted to 137,000 tons of "N," the 1945-46 imports amounted to 154,000 tons or a reduction of 17,000 tons. Adding our imports and our indigenous production for the same ten months, a total figure of 685,000 tons is seen in 1946-47 against 634,000 tons in 1945-46, or an increase of 51,000 short tons of "N." It is estimated that for the full year of 1946-47, the increase will be from 55,000 to 60,000 tons over last year.

Ten month's production of fertilizer year exceeded same period of last year by some 40,000 tons of Nitrogen. Solutions are up by 29,000 tons, illustrating extent of gain.

A great deal of interest in the U. S. export program has been evidenced lately. It would be of interest to know how this program is handled. Assuming the State Department feels there is a need on the part of the Government to participate in supplying the world's nitrogen needs, a meeting is called of representatives from the Departments of State, Commerce, and Agriculture, together with other interested governmental agencies, and a determination is made as to the amount of exportable materials which may be offered through the International Emergency Food Council for allocation by that body. This, added to the exportable surpluses from the five exporting countries makes up the export pool or the amount which may be distributed to the claimant countries of the world. Recommendations for the allocation of fertilizer materials are made by the Fertilizer Sub-Committee of the Council. This Committee is composed of fourteen members. The United States has one member with an alternate and our participation as far as the allocation of these materials, is the same as any other country represented on the Council. There are 34 member countries represented, any or all of which may be claimant countries. This Committee recently voted to discontinue the allocation of phosphatic and potassic materials but voted unanimously to continue the world allocation of nitrogen. There are at the present time only five countries with an exportable surplus of nitrogen. They are: Chile, Canada, United Kingdom, Belgium, and Norway. The United States is a net importer of nitrogen and yet in order to protect imports as well as to fit in with domestic distribution pattern, it is essential that the U. S. participate by exporting some of its own nitrogen production.

Exports must be principally, if not entirely, solid material. Few, if any, claimant countries have facilities for using liquid nitrogen and even if they did have such facilities, there would still be no way of getting the material to them since tanks are not available.

The original U. S. export program in 1946-47 amounted to 97,000 short tons of N." During the coal, steel and other strikes, the United States felt that this exportable tonnage should be reduced by approximately 30 percent. The new figure established was 67,000 short tons of "N," or 61,000 metric tons. The principal claimant countries supplied by the United States were France, Netherlands, China, Philippines, Latin American countries, and Finland. The materials exported were sulfate of ammonia and ammonium nitrate. After a breakdown was made between sulfate of ammonia and ammonium nitrate, each producer was given his pro-rata share predicated on his actual production figures. This was done in order to make as equitable a distribution of exports as possible.

You have probably heard a great deal about the Army having borrowed from the American producers of ammonium nitrate, approximately 110,000 tons of this material last fall while some of the Ordnance plants were being reactivated. This material has practically all been returned and again in order to minimize disturbance to domestic production during the heavy consuming months, from January to July, all of this material returned by the Army was directed to the export program.

Since the Texas City disaster, considerable difficulty has been experienced in prevailing upon Longshoremen to handle ammonium nitrate. This is probably not particularly a result of fear on the part of the Longshoremen, but rather that they are holding out to get explosives rates for stevedoring this material. If the material is adjudged "non-explosive," the present stevedore rate probably will prevail and if not, it is understood that the stevedore rates will advance appreciably. Production from Army Ordnance plants goes only to the occupied areas of Japan, Formosa, and the United States-United Kingdom zones of Germany. None of this material is available to domestic agriculture at the present time.

The fertilizer industry should feel proud of its production accomplishments during the war. The Government owes a debt of gratitude to the industry, and to the members of the several advisory committees who aided the Government in the formulation of policies.★★

Field Notes of a Du Pont Service Man
TIMELY REPORTS... which reflect the progress of chemical science in providing more effective tools for farm pest control.
AUGUST, 1947
SUBJECT: Solubility of 2,4-D Weed Killers in Hard (Alkaline) Water
AREA: South Dakota
Douglas County officials selected Du Pont 2,4-D Weed Killer for use in an extensive program to control field bindweed and clean up weeds along roadsides and right of ways.
Several formulations, including Du Pont's, were tested to determine their solubility in the extremely hard water of this area. Test solutions were prepared by mixing two teaspoonfuls of each 2,4-D sample in a quart of water...the hardest water that could be found in the county.
Du Pont 2,4-D went into solution immediately and performed in exactly the same fashion as when mixed in soft water. There was no foaming or precipitation, nor were there any secondary reactions with Du Pont 2,4-D. The officials conducting these tests were favorably impressed with Du Pont 2,4-D.

Complete solubility, freedom from foaming and absence of secondary reactions were all factors of first importance to Du Pont scientists in formulating 2,4-D.

Extensive research indicated that the monohydrated sodium salt form of 2,4-D used in Du Pont's formulation offered the greatest convenience to users in all areas.

Results such as those reported above confirm the effectiveness of Du Pont 2,4-D under the most exacting field conditions.

For new and better farm chemicals today... and in the years ahead . . . look to Du Pont.

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BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

DU PONT PEST CONTROL PRODUCTS

Comments....

By Dr. Alvin J. Cox

This column by Dr. Cox appears as a regular feature of AGRICULTURAL CHEMICALS. Dr. Cox formerly was successively Physical Chemist, Chief Chemist, Assistant Director, and Director of the Bureau of Science, Government of the Philippines. He was appointed Chief, Bureau of Chemistry, California State Dept. Agriculture in 1932, retiring in 1945.

Last month Dr. Cox reported some of the papers and discussions from the Pacific Slope Branch meeting of the American Association of Economic Entomologists, Berkeley, Calif., June 23, 24 and 25. This month's installment concludes his report.

—THE EDITOR

W. J. O'Neill, Tree Fruit Branch Experiment Station, State College of Washington, Wenatchee, spoke on "Insecticides in Relation to Beneficial Insects on Deciduous Fruits." Control of apple and pear pests can almost be divided into "Before DDT" and "After DDT." A survey of orchards in central and southern N. J. in 1936 and 1937 showed parasitism of codling moth larvae to be inversely proportional to the number and thoroughness of the spray treatments in the respective orchards.

A "biological control" program was attempted in the three year period of 1938-40. Some 30,000 codling moth eggs were exposed to natural enemies, and predators were the most important single factor in egg destruction. By the end of the third year, the "biological control" orchards showed 80% of the fruits to be infested, and but 2% in the sprayed orchard. It was thus concluded that until better biological agents are discovered, production of moth-free apples must depend upon chemical pest control.

Dr. Paul DeBach, Univ. of California Division of Biological Control, Riverside, presented a paper entitled, "The Effect of Insecticides on Entomophagous Insects in Citrus Groves." There is definitely a relationship between the population of red mite and the build-up of predators, but it is difficult to separate the factors involved, he said. An insecticide can adversely affect insectivorous insects by being directly toxic to them; "inert" diluents can affect the environment so that predator populations are decreased, and they can be eliminated by starvation following drastic reductions of the host by insecticides.

Laboratory and field work with the cottony-cushion scale, showed DDT to be extremely toxic to its predator, Australian lady bug (Vedalia). Many citrus groves in Central California became heavily infested with cottony-cushion scale following the use of DDT in 1946. Residues of wettable DDT applied as a spray (2 pounds actual DDT per acre) remained toxic to vedalia for at least 69 days under field conditions.

Following winter or spring DDT applications in 1946, cottony-cushion infestations were generally "cleaned-up" by fall; retreatments with DDT after July 1, however, resulted in the effective exclusion of vedalia for virtually the entire year. Indications are that DDT treated groves act as traps which may drain the reservoir of vedalia in an area.

Predators of the citrus red mite were shown to be adversely affected by various materials under field experimental conditions. DDT produced definitely detrimental effects for from 2-4 months. Pyrophyllite, cryolite, zinc sulfate, and chlordane had an inhibitory effect on the rate of increase of citrus red mite predator populations. "DN-111" and dichlorophenoxy-methane produced a similar effect on predators but probably as a result of starvation due to reductions in red mite populations.

Predators of the long-tailed mealybug were found to be effectively reduced over a considerable period by DDT. Talc was also detrimental to predator populations. However, parasites of the long-tailed mealybug were not adversely affected by DDT, but were actually favored due to the reduction in competition with predators. (The results presented were largely screening tests.)

In concluding the symposium Prof. Smith called attention to the danger of drawing conclusions from limited data. Today's situation is different from earlier periods, he pointed out. Red spiders and some other pests are now more difficult to kill, and this is associated with applications of insecticides which may have shocked or had an effect on the tree.

There may be enemies of the codling moth where it originated. Its cocoon and egg stage is susceptible to predators and biological control. We can use advantageously both

New Officers Named

Officers elected at the Pacific Slope meeting were: Chairman, W. J. O'Neill; Vice-chairman, J. N. Roney; and secretary, Roy Campbell. Meeting place of the 1948 meeting was announced as Vancouver, B. C., Canada. Dates will be June 16, 17 and 18.

Dr. Freeborn discusses research, Dickson insect habits, Loeffler the residual toxicity of DDT, and Carman compounding and formulation studies of DDT and analogues

biological control and control by means of insecticides. We need to undertake more fundamental investigations and cooperate more closely to enable us to answer the questions involved.

Research Discussed

DR. S. B. Freeborn, University of California, Berkeley, on the afternoon of June 24th discussed "The Role of State Experiment Station Research in Entomology." The function of the experiment station is to protect man and crops against insects. The most effective type of work to accomplish this is basic research. Chemical control is now in the limelight. All but 18 of the 57 professional entomologists in the California Agricultural Experiment Station are working on chemical control. Thirty years ago, one could count on his fingers the insecticides from lime-sulfur to kerosene emulsion, but shortly after, prepared products began to appear. Chemical manufacturing companies in the U. S. have many thousands of products worth screening for useful products. Millions of dollars are spent in research against one insect, yet we still do not know how the insecticide kills. With rgeard to chemicals involved in grants, researches in the order of desirability are as follows: (1) Cooperation with manufacturing industries with regard to new products of known composition; (2) contractua! research; (3) mass type, that is, research of proprietaries. It is necessary to keep abreast of commercial developments, but the industry is best equipped to do its own screening.

Dr. J. N. Roney, University of Arizona, Phoenix, reported on "Beet Army Worm as a Pest of Flax." The common beet army worm is a pest of cotton and alfalfa. It injures cotton only if the first generation misses parasitism. The larvae (25 to 40 per square yard) feed on the tops and therefore the most valuable part of flax. One application of 20 lbs. DDT dust by airplane gave control. This insect can become a major pest of flax unless controlled promptly.

Dr. R. C. Dickson, University of California Citrus Experiment Station, Riverside, spoke on "Diapause in Insects." An insect will hibernate only at one stage in life cycle. Autointoxication, absence of a growth hormone, food, water, and inheritance may be the factors inducing diapause, he said. The oriental fruit moth enters hiberation between September 1 and October 15, because the hours of light then are 11 to 13 per day. The larvae hibernate only when the temperature is between 21° and 26°C. The best ratio of light to dark is 12:12 hours. The day was broken to a ratio of 9:9; 6:6; and 3:3, and but few larvae hibernated. The minimum effective light intensity was 3-foot-candles on fruit.

Dr. Erwin S. Loeffler, Shell Oil Co., Martinez, California, read a paper entitled "The Determination and Study of the Toxicity of Residual DDT Deposits." Two milligrams per square foot were still effective after 3 days on non-absorbent galvanized iron surfaces. There was increase in toxicity on wood after 20 days as the solvent evaporated.

Dr. William M. Rogoff, University of California Citrus Experiment Station, Riverside, presented a paper entitled "Measurement of Repellency to Greenhouse Thrips of 'Velsicol 1068' and DDT." His method was to count thrips on treated and untreated leaves. At concentration above 0.0004%, chlordane showed repellency. For DDT the factor is 0.006%. There is a relationship of about 1:15. Benzene hexachloride showed no repellency.

William F. Chamberlain, University of California, Berkeley, presented a paper, illustrated by lantern slides, entitled "The Toxicity and Repellency of Organic Compounds Towards Termites and Their Use in Termite Proofing Food Packages." He used the arena method in which one-half of the bottom of the test chamber was treated and the other untreated. Highly volatile materials did not have sufficient residual effect. DDT showed only limited possibility.

Dr. G. E. Carman, University of California Citrus Experiment Station, Riverside, presented a paper entitled "Compounding and Formulation Studies of DDT and Analogues of DDT." A group of 230 formulations of DDT wettable spray concentrates, dust mixtures and solutions were compared in an extensive series of bio-assay determinations and by means of appropriate chemical and physical measurements. Approximately 45 solid dispersants and 50 organic solvents were involved in the formulations examined. Other variations of wettable spray concentrates and dust compositions were based on DDT of eight different sources and degrees of purity, on various methods of compounding, and on varied proportions of DDT to dispersant. Fifty analogues of DDT were also included in the investigations. Eighteen specics representing eight orders of insects and the citrus red spider were used for the toxicity determinations. Results of the investigations indicate the importance of formulation with regard to DDT preparations and the differential toxicity of DDT and the analogues of DDT to the insects and mites involved.

Dr. R. L. Metcalf, University of California Citrus Experiment Station, Riverside, presented "Investigations of Phosphoric Acid Esters." Laboratory toxicity studies of a number of phosphoric acid esters indi-

cated that tetraethyl pyrophosphate (TEPP) and an aryl alkyl, thionophosphate (3422) were outstandingly toxic to citrus red mite and greenhouse thrips, the TEPP being more toxic to the citrus mite and the 3422 more toxic to thrips. Hexaethyl tetraphosphate (HETP) was considerably less toxic than these materials, while the methyl, propyl, butyl, and amyl esters were less effective than the ethyl ester. The rates of hydrolysis of 1 percent solutions of TEPP and HETP were compared with regard to the effect on insecticidal action, and it was shown that HETP became non-toxic after about 12 hours hydrolysis, while TEPP became non-toxic after about 24 hours. HETP dust preparations involving 80 different formulations were studied as to lasting properties under conditions of storage and application. A volcanic ash and a gypsum appeared to be the most suitable diluents. TEPP dusts possessed greater stability than HETP.

Deane P. Furman, University of California, Berkeley, spoke on the subject "Benzene Hexachloride for the Control of Cattle Lice." There are 4 species of lice on cattle in California. As little as 0.06% was effective. In 3 days all adult lice were killed. Use 0.3% for commercial dipping. A third drenching is required. 0.15% was uniformly effective by dipping, and no eggs hatched. The toxicity of benzene hexachloride to cattle lice is manifested in 3 ways: (1) By complete kill of all mobile stages, (2) by ovicidal action on the short and long nose cattle lice, and ovicidal action on the cattle bitting louse, and (3) by a lethal action to emerging nymphs. The possibility of absorption and appearance in milk and meat of treated animals is not known at this time.

Charles F. Doucette, Sumner, Washington, discussed "Host Plants of the Cabbage Seedpod Weevil." Some of the radishes and condiment mustard are resistant to it. Wild mustard, broccoli, turnip, etc., are subject to infestation. The study was carried on to learn just what to expect with respect to seed crops. Still to be determined is what it will do in other states such as Idaho and California.

Final day of conference one of the best with symposium on "new insecticides" as feature. Drs. Haller, Gunther, Jeppson Boyce and Ewart are featured as speakers

Lester W. Hanna, General Foods Corporation, Hillsboro, Oregon, discussed "Ethylene Dibromide in Treating Strawberry Rust Weevil." When adults by-pass poisonous bait other control measures are required. Three inches from the crown, six cubic centimeters of 10% solution of ethylene dibromide are injected 5 to 6 inches into the soil, where it becomes a gas. The application of six cubic centimeters was so successful that every plant in a whole field was treated at a cost of $36 per acre. If the weevils by-pass the bait, early treatment in the fall assures better plants the next year.

Final Day

THE morning session of June 25 was opened with a symposium on "New Insecticides" under the leadership of Dr. W. M. Hoskins, University of California, Berkeley. His own paper was entitled "Opportunity and Responsibility in Insecticide Research." In it he gave a prominent part to discussion of new insecticides. Although no insect species has been exterminated, control methods have greatly reduced the damage they may do. There has been increase in the milk from fly-free cows, and livestock gain more weight when they do not have to feed and fight flies. On the other hand, development of insect resistence to present new insecticides may eventually result. There is great need of basic principles to guide studies.

The search for new insecticides has continued many years. Soluble rather than insoluble materials were first developed. Physical properties were the principal guide. Calcium chloride is an insecticidally inert material, but calcium polysulphide is well known for its effectiveness. On the other hand, calcium sulphate is without effect. Sodium fluosilicate is of relatively low toxicity, whereas sodium fluoride is highly toxic. Hydrogen, carbon, and nitrogen are innocuous, yet hydrogen cyanide is a violent poison. One line that offers a new basis for work is to learn what toxic chemicals actually do in the pest animal. For example, enzymes in the gills of fish participate in their oxygen intake. Hydrogen cyanide forms a tight combination with these enzymes. It is possible that any and all physiological functions may be affected. There is need for information where a particular function can be broken down.. The effect of the essential metabolite inositol in diminishing the toxicity of benzene hexachloride to yeast possibly is useful in interpreting the combined action of many chemicals upon insects. The effect of sulfanilamide upon disease-producing bacteria is likewise an interference with an essential function. There is great need for insect biochemistry.

Dr. H. L. Haller, Assistant to the Chief, Bureau of Entomology and Plant Quarantine, Washington, D.C., discussed "Some Problems Relating to the Development of New Insecticides." Only since 1867 has the hunt for new insecticides been under way. Experiments with wetting, spreading, and other properties have been studied to learn how insecticides kill. Research has been successful in finding many new insecticides, and discoveries came at a time when they were most needed.

Physical and chemical studies, such as compatibility and synergism,

are numerous. Some problems that are presented to the chemist are to work out methods of analysis for chlorinated compounds such as "DDD," benzene hexachloride, and chlordane. Present physical, chemical, and biological methods of testing and expressing evaluation for DDT and similar new products were discussed. Besides knowing the solubility, composition, chemical and biological methods of testing of a compound itself, it is necessary to have knowledge of it in dusts, sprays, and in combination with other products.

Dr. Robert L. Metcalf, University of California Citrus Experiment Station, Riverside, spoke on "Specific Toxicity of New Insecticides." He pointed out that many of our present day organic insecticides are too universally toxic both to invertebrates and vertebrates. However, other organic materials show very puzzling examples of specific action against a few insects. Fundamental investigations of these cases of specificity should be made with the goal of developing materials innocuous to mammals, yet highly specific against certain insect pests. Slides were presented showing examples of insecticidal specificity of organic compounds as related to chemical, physical, and physiological effects. Dr. Hoskins summarized the symposium by emphasizing the need for knowledge of physical effect of insecticides on insects.

In addition to previous talks on the subject, Dr. A. M. Boyce, University of California Citrus Experiment Station, Riverside, spoke on "Some Aspects of Research in Citrus Entomology." He stated that for various reasons the entire citrus pest control program needs overhauling. At Riverside studies are in progress along lines of improvement of existing pest control materials and methods of application, and also the development of new materials and methods that do not adversely affect the productiveness of the trees nor the quality of the fruit. Research is still in progress on hydrogen cyanide, the oldest important citrus insecticide. The aim is to develop the most effective and most economical insecticides that have no influence on fruit quality. Many materials have been studied. DDT shows promise in control of most major citrus pests except mites, but it is impossible yet to tell if DDT will fit into the citrus pest control problems.

Dr. Lee R. Jeppson, University of California Citrus Experiment Station, Riverside, presented a paper with lantern slides on "Field Studies with New Materials for Control of Citrus Mites." The use of DDT has made the control of plant feeding mites come to the front. Several materials that looked promising have been evaluated in the field. "899," "DN-211," and DDT in kerosene have shown some promise in control of citrus bud mite. For the control of citrus red mite, "899" is effective only as a regular spray, "K-1875" is effective as dusts, concentrate, and dilute spray applications. Organic phosphates are not toxic to red mite eggs.

Dr. F. A. Gunther and Miss M. I. Elliot, University of California Citrus Experiment Station, Riverside, presented a paper entitled "Studies of the Penetration of Field-Applied DDT into Citrus Fruits, Avocados, Olives, and Apples and Pears." With navel and Valencia oranges, DDT in oil solution penetrates into and through the flavedo and permeates the albedo of the rind. As a dust, however, DDT appears to penetrate only into the flavedo. Penetration of DDT into the pulp and juice of these citrus fruits has not been observed, and, in general, there appears to be a greater degree of penetration with the navels than with the Valencias. The paper went on to discuss the penetraeion of DDT into avocados, olives, apples and pears, and a description was given of methods used to wash away DDT surface residues.

Dr. L. A. Riehl, University of California Citrus Experiment Station, Riverside, presented a paper on "The Susceptibility of Unfertilized vs. Fertilized Adult Female *Aonidiella aurantii* (Mask.) to Petroleum Spray Oil." When crawlers of California red scale were placed on mature grapefruit and raised there under certain laboratory conditions, a large percentage of the female scale present 36 days after infestation had not been fertilized. Unfertilized scale can be distinguished easily from those fertilized, when mortality counts are made. The oil was applied in aqueous emulsion according to the tank mix method. Probit dosage mortality curves were determined. Results obtained show that only one-half to two-thirds the amount of oil needed to kill fertilized scale was required to give comparable kills of unfertilized scale.

J. C. Ortega presented a paper on "*Pyroderces rileyi* (Wals.) as a Pest of Valencia Oranges." This pest occurs in the fall under the buttons and produces some scars. It makes small, shallow holes not easy to detect in the packinghouse. The injured fruit, if shipped, is likely to decay.

Dr. W. H. Ewart presented a paper with lantern slides on the subject "Field Tests for the Control of Citrus Thrips and Unarmored Scales of Citrus." Of many new materials used, DDT was the most promising of all species of unarmored scales, except cottony cushion scale and citrus thrips. Studies in 1944 and 1945 showed that a dust composed of 2 percent DDT and 90 percent sulfur used at 150 lbs. per acre in the first application, and at 125 lbs. in the second application was highly effective in control of both citricola scale and citrus thrips. However, in 1946, a partial second generation of this scale insect developed, and the DDT-sulfur dust program was not effective in control, although it was effective in thrips control. Wettable DDT is effective in control of both citricola scale and citrus thrips. DDT in kerosene is effective in control of citricola scale during late winter. The use of DDT for control of citricola scale and citrus thrips in central California has, in many instances, resulted in a build-up of the cottony cushion scale through destruction of the predator, vedalia.

Dr. D. L. Lindgren reported on "Nylon Tents in Citrus Fumigation." Prior to the war an average of 45,000 acres of citrus were fumigated

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The Listening Post

Insect Conditions In Late June and Early July

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

THE boll weevil situation has continued serious in North Carolina, South Carolina, Georgia, Alabama, and Mississippi, and in some areas in Louisiana, Arkansas, Texas, and Oklahoma. Rains and mild temperatures have been favorable for weevil increases in most of these States and cotton growers have been advised to be prepared to treat their cotton with insecticides when the weevils become abundant.

Cotton fleahopper infestations were still on the increase in central and south-central Texas shortly after the middle of June. Toward the end of the month fleahopper populations were said to be reducing rapidly below the damaging point in many fields in the southern counties of the State, as a result of dry weather, maturity of the cotton, and toughening of the terminal buds. An examination of 25 fields in central Texas on July 3 showed an average of 29.9 fleahoppers per 100 terminals, which exceeded the average number for that date in each of the previous six years. The only other areas in which this insect has been reported unusually abundant are Pinal and Pima Counties of Arizona.

The first cotton leafworms reported this year were found in Nueces County, 8 miles south of Corpus Christi, Texas, on June 21. The second finding reported was in Calhoun County, near Port Lavaca, Texas, on June 30. The leafworm was not reported from any other counties by July 12.

The bollworm, which usually does not show up in Louisiana until early August, was reported to be causing severe damage to cotton throughout the State during the last week of June. Bollworms were also reported as destructive at that time in Marion and Walthall Counties, Mississippi, while only a few worms were reported in the Delta Counties. No serious bollworm infestations had been reported from Texas by the end of the first week in July.

Results of a survey for the vetch weevil carried on in Texas from May 19-22, inclusive, are now available. Sweepings for adults and a search for eggs on the immature pods in at least 90 percent of the area in which hairy vetch is being grown for seed in Brown, Comanche, Erath, Eastland, Mills, and Palo Pinto Counties failed to reveal the presence of this weevil in any stage of development in any of the 36 fields examined.

The Mexican bean beetle has continued to cause moderate to severe injury to beans in most of the southern states and in northwestern Tennessee. Infestations have been light to moderate in the remainder of the states reporting, including Maine, New Jersey, Ohio, Nebraska, Wyoming, Colorado, and Utah.

Adults of the Japanese beetle began to appear about the middle of June in the vicinity of the District of Columbia. They caused considerable damage to snap beans, pole and bush lima beans, and soybeans in eastern Virginia during the last part of June and first half of July.

Populations of cabbage caterpillars have been reported as generally light during the last half of June and early July in New Jersey, eastern Virginia, North Carolina, Florida, northern Tennessee, Ohio, Minnesota, and Idaho. Heavier infestations occurred early in June in South Carolina, Georgia, and Alabama.

Further surveys for the cabbage leaf beetle in the known infested area in Mobile and Baldwin Counties, Alabama, disclosed that few adults of this bettle were still active the first week of July. The preferred host plants were scarce at that time and no new infestations have been discovered.

Destructive populations of the harlequin bug were present on cole crops in Virginia, Georgia, and Tennessee toward the middle of July.

Most of the dusting operations for control of the pea weevil had been completed by the middle of July in Idaho, Washington, and Oregon.

Generally light infestations of the pea aphid have prevailed in Maine, Maryland, and Wisconsin, but alarming populations developed on late peas grown at the higher elevations of the Blue Mountain district of Washington-Oregon.

The unprecented outbreak of the green peach aphid on tobacco has continued in northern Florida and in Georgia and infestations of this aphid on tobacco were reported in early July from Alabama and South Carolina. In Florida the infestations were reported to have increased greatly in shaded tobacco plantings during the first week of July, apparently as a result of spread of the insects through harvesting operations and ineffectiveness of insecticide applications in high tobacco of the shade-grown type.

By the end of June the hop aphid was said to be more numerous than for several years on hops in central Washington. At that time the winged aphids had practically completed migration from prunes to hops and control operations were well under way in hop yards in the Willamette Valley. Considerable damage from this insect was occurring in some hop yards the first week of July. Good kills of the hop aphid

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Progress in Soil Fumigation Methods

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

RAPID strides have been made recently in the development of soil fumigants and especially in their use for large scale application. This account is taken from an article prepared for the *Plant Disease Reporter* by Dr. Jesse R. Christie, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.

The purpose of soil fumigation is to control soil-inhabiting organisms that injure the roots of plants or otherwise interfere with the growth of a crop. The practice aims, in some measure, to accomplish below ground what spraying and dusting accomplish above ground.

The most effective chemicals give off toxic fumes which diffuse in the soil through volatilization or chemical reaction. Because the fumes diffuse to only a short distance from the point of application, volatile liquids are injected into the soil at closely spaced intervals. Solids are usually applied in powdered or granular form and mixed with the soil mechanically. Chemicals capable of killing such soil-borne organisms as nematodes, fungi, insects, and weed seeds are very likely to injure the roots of plants, so fumigants are applied before the crop is planted.

The best known and most widely used soil fumigants are composed of or have as the principal active ingredient one of the following chemical compounds: 1,3-dichloropropene, 1,2-dibromoethane (ethylene dibromide), trichloronitromethane (chloropicrin), and bromomethane (methyl bromide). Dichloropropene is not available in pure form. The soil fumigant known as "D-D" (see Table 1) is a dark colored volatile liquid said to be a mixture composed of about equal parts 1,3-dichloropropene and 1,2-dichloropropane with small quantities of other chlorinated compounds. "Dowfume N" is of similar composition. Ethylene dibromide is a commercial product used for various purposes and the liquid is available in more or less pure form. Chloropicrin (tear gas) is a liquid at ordinary temperatures and is usually applied to the soil without diluting. Methyl bromide, a widely used fumigant, is a gas at ordinary temperatures (boiling point about 40°F.) and for soil fumigation it is mixed with some diluent with a higher boiling point in order that it may be handled and applied as a liquid.

Dichloropropene mixtures and ethylene dibromide are the soil fumigants suited to large-scale application. Because chloropicrin and methyl bromide require measures for confining the fumes in the soil, such as placing over the treated area a gas-impervious cover or sprinkling the surface with water, the use of these fumigants is restricted largely to greenhouses and seed beds or field areas of small size where water is available. Methyl bromide requires careful attention to measures for confining the fumes in the soil but it is not highly toxic to plants and mixtures containing this chemical are useful in greenhouses.

For controlling most nematodes, including the root-knot nematode, dichloropropene mixtures, ethylene dibromide, chloropicrin, and methyl bromide are all effective when properly applied. For cyst-forming species, such as the sugar-beet nematode and the golden nematode of potatoes, dichloropropene mixtures have given the best results. For controlling fungi, chloropicrin is by far the most effective. Chloropicrin is the only soil fumigant sufficiently effective in destroying weed seed to be recommended for this purpose. Under certain conditions, presumably where most of the weeds have started to germinate before the fumigant is applied, moderate to heavy applica-

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TABLE 1.—Soil fumigants sold under trade names

Trade names	Principal active ingredient	amt. by wt.	amt. by vol.	Diluent(s)	Manufacturer
		%	%		
"D-D"	Dichloropropene	—	—	See text	Shell Chemical Corp.
"Dowfume N"	do.	—	—	See text	Dow Chemical Co.
"Dowfume W-40"	Ethylene dibromide	—	40	Naphtha	do.
"Dowfume W-10"	do.	10	—	do.	do.
"Garden Dowfume"	do.	5	—	do.	do.
"Iscobrome D"	do.	10	—	do.	Innis, Speiden & Co.
"Soilfume 60-40"	do.	20	42	do.	Westvaco Chlorine Products Corp.
"Soilfume 80-20"	do.	10	24	do.	do.
"Bromofume-40"	do.	—	40	do.	Eston Chemicals, Inc.
"Bromofume-20"	do.	—	20	do.	do.
"Bromofume-10"	do.	—	10	do.	do.
"Larvacide"	Chloropicrin	—	—	None	Innis, Speiden & Co.
"Dowfume G"	Methyl bromide	10	—	Carbon tetrachloride & ethylene dichloride	Dow Chemical Co.
"Iscobrome No. 1"	do.	15	—	Xylene	Innis, Speiden & Co.

Technical Briefs

Granary Moth Control

The moths in a large wheat granary were controlled by spraying with a solution of 0.8 percent of pyrethrins in petroleum oil, which gave a deposit on the wheat of 1.5 mg. per square centimeter. This treatment did not affect the number of migrating larvae of this moth. R. W. Owen and N. Waloff, *Ann. Applied Biol.* 33, 387-9.

•

Ovicide Gives 100% Kill

Aqueous sprays containing 0.1 percent of *gamma*-hexachlorocyclohexane in suspension, applied to eggs of *Haematopinus eurysternus*, killed 100 percent of the eggs. A cow was freed of lice with one application of the 0.1 percent suspension. R. W. Wells and W. L. Barrett, Jr., *J. Econ. Entomol.* 39, 816.

•

New Plant Insecticide

A new insecticidal plant has been found in the indigo bush. The toxic principle, not yet determined, is called amorpha, and occurs in resinous pustules in the pods. Amorpha acts both as a stomach and contact poison. The extract has not included any highly toxic material but was found effective in the control of a few insects. The extract persists for more than 12 hours as an insect repellent. Little is known of its toxicity to mammals. C. H. Brett, *J. Agr. Research* 73, 81-96.

•

Treating Sheep With DDT

The biting sheep louse, *Trichodectus ovis*, which causes sheep to lose weight and wool, is controlled by dipping the animals in a DDT-pine oil mixture, formulated as follows: One part of technical DDT is dissolved in 5 parts of water-miscible pine oil (U. S. Navy specification CS 69-33) by warming 10 pints of this mixture in 100 gallons of water. The dip contains about 0.2 percent of DDT. This mixture will not make a satisfactory emulsion in alkaline aqueous solution. An animal is thoroughly wetted by a single submergence. H. E. Parish and C. A. Rude. *J. Econ. Entomol.* 39, 546 (1946).

•

DDT for Seed Protection

Dusts containing 2.5-20 percent DDT and pyrophyllite, and applied at 1 ounce per bushel of seed, controlled 8 species of stored-product insects in 15 kinds of seed. Dusts containing less than 2.5 percent DDT were not completely effective. Seeds treated with dusts containing 5-20 percent DDT grew satisfactorily when tested in a standard seed germinator. The seeds tested included wheat, sweet corn, barley, field corn, squash, popcorn, ming bean, lettuce, beans, muskmelon, cucumber, oats, watermelon, tomato, and peas. M. D. Farrar and J. M. Wright. *J. Econ. Entomol.* 39, 520-2 (1946).

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Aquatic Insect Control

Various species of aquatic insects show great differences in susceptibility to DDT. On ponds a 12 percent solution of DDT on oil applied at 1 gallon per acre (1 pound of DDT) exterminated practically all the surface insects and those breathing at the surface. Most free-swimming or crawling insects in ponds were severely reduced in numbers and some were exterminated. Insects in the bottom of ponds were relatively safe even at dosages of 5 pounds of DDT per acre. C. H. Hoffmann, H. K. Townes, R. E. Sailer, and H. H. Swift. U. S. Dept. Agr., Bur. Entomol. Plant Quarantine Bul. E-702, 20 pp. (1946).

•

Extractives for Sprays

Powdered extractives of rotenone-bearing plants were dissolved in spray oil at room temperature in concentrations of insecticidal value by mixing the powder in oil for 20 minutes. An emulsive oil was found to be a better solvent than a straight oil of the same grade. A mutual solvent was required to obtain the highest concentration. The term "oleotropic" is proposed for mutual solvents, which when added in large amounts, will increase the solubility of an otherwise insoluble or slightly soluble substance in oil, merely by adding their solvent properties to that of the oil. No rotenone-plus-deguelin passed from the oil to the water phase of an oil-water mixture when the extractives were in true solution. A colloidal solution in oil lost from ¼ to 1/3 of its rotenone-plus-deguelin content.

"Cardolite 627" was a highly efficient solubilizer for incorporating derris extractive in spray oil. *n*-Butyl phthalate was a good oleotropic solvent, but it formed a slightly cloudy solution when 5 percent derris extractive in *n*-butyl phthalate was added to spray oil at a 1:7 ratio. A derris extractive dissolved in oil plus *n*-butyl phthalate was more effective at the same strength against California red scale than when "Cardolite 627" was the solubilizer. When 0.031 percent rotenone was placed in solution in kerosene by "Cardolite," it lost its toxicity within 6 weeks. The decomposition could be retarded by anti-oxidants such as hydroquinone. The toxic ingredients of derris root were not as readily extracted by spray oil as those of cube root. The best mutual solvents from the standpoint of insecticidal effectiveness may have to be added to the oil just before spraying in order to avoid precipitation. W. Ebeling, F. A. Gunther, J. P. LaDue, and J. J. Ortega, *Hilgardia 15*, 675-701.

•

Control of Blowfly Larvae

Treatment of carcasses was studied for killing blowfly larvae. *ortho*-Dichlorobenzene and acetylene tetrachloride, sprayed at 1 pint per 25-40 pound carcass, killed the larvae almost instantly. When diluted 1:4 with fuel oil, these compounds were highly effective for the same purpose. An emulsion of 20 percent benzene hexachloride, 68 percent benzene, and 12 percent "Triton X-100" (poly-

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ethylene glycol alkyl aryl ether), diluted 1:4 and 1:9 with water, gave high kills of maggots at 1 pint per carcass, and highly effective control but slower kill at 1:39. Xylene and two commercial solvents were less effective in immobilizing the larvae. "Thanite," 20 percent in fuel oil, gave good kills of blowfly larvae but was slow in action. DDT should be added to all larvicides, except possibly those containing benzene hexachloride, for its residual effect on flies that visit carcasses. W. C. McDuffie, A. W. Lindquist, and A. H. Madden, *J. Econ. Entomol.* 39, 743-9.

•

Grasshopper Control Studied

U.S.D.A. bulletin No. E-722 describes the use of new insecticides in grasshopper control. Data was compiled by E. J. Hinman and F. T. Cowan of the Division of Cereal and Forage Insect Investigations, U.S.D.A. Tests were made in 1946 in Montana, Arizona and California. The most promising material was chlordane, technical grade, used both as a spray and a dust. A mortality of 90 percent or better was achieved by using the material in emulsion spray at 1 pound per acre. Residues of the material were effective for 26 days in Arizona, and for 10 days in South Dakota where rain eliminated further effect, No harm was done to a colony of honeybees placed in a sprayed plot a few hours after treatment.

Benzene hexachloride containing 10 percent of the gamma isomer was tested in emulsified and dust form. Field tests at 2 pounds per acre brought approximately 70 percent mortality in alfalfa, and field tests at 3 pounds per acre in an emulsion averaged 90 percent kill.

SMALL PACKAGES

(*Continued from Page 20*)

trict of Columbia, Idaho, Illinois, Indiana, Kansas, Kentucky, Massachusetts, Mississippi, Nebraska, Nevada, New Mexico, Oklahoma, Rhode Island, and West Virginia.

An important recent development of interest and affecting all manufacturers was the drafting of a so-called uniform state insecticide, fungicide, and rodenticide act by the Council of State Governments in cooperation with federal and state officials and with representatives of industry. This bill is satisfactory to industry. During the 1947 sessions of the legislatures this model bill was introduced in the following states: Colorado, Indiana, Iowa, Massachusetts, Montana, New Mexico, New York, North Carolina, North Dakota, Rhode Island, South Dakota, Utah, Vermont, and West Virginia.

It has become a law in a number of these states.

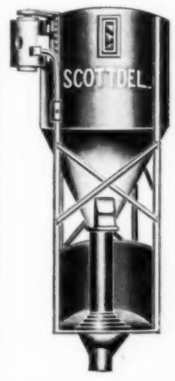
The model bill contains the following ingredient statement options:

1. A statement of the name and percentage of each active ingredient, together with the total percentage of the inert ingredients, in the economic poison; or
2. A statment of the name of each active ingredient, together with the name of each and total percentage of the inert ingredients, if any there be, in the economic poison (except Option 1 shall apply if the preparation is highly toxic to man, determined as provided in Section 5 of this Act); and, in addition to (1) or (2) in case the economic poison contains arsenic in any form, a statement of the percentages of total and water soluble arsenic, each calculated as elemental arsenic.

Another matter of interest to manufacturers is that of registration fee requirements. In the new laws which were passed during 1947, following or patterned closely after the model state bill, New York and Montana required no fees; North Dakota and South Dakota required a fee of $5 per item for the first five items and thereafter $1 each; in Vermont the fees are $5 per item with a maximum fee of $50 for the entire line.

The Senate has recently passed H. R. 1237, which was introduced by Congressman August H. Andresen of Minnesota. This bill is substantially the same as the Council of State Governments' state model bill. It is considered to be a very favorable bill and the industry was pleased when it became law. It is expected to improve materially the chances of getting uniform economic poison legislation in the various states.

There are, of course, many other legal problems involved in connection with the manufacture and sale of economic poisons, such as non-uniform color requirements, restrictive pharmacy law provisions and unsatisfactory poison law requirements. A full discussion of these subjects, however, is not included in this article.★★



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Propose New Federal Specifications for
DDT and Emulsion Concentrates

TWO new proposals for Federal specifications for DDT and DDT-emulsion concentrate were submitted for industry approval in July by Harry Fleisher, chairman, subcommittee on DDT, Technical Committee on Insecticides, Federal Specifications Board, Bureau of Federal Supply, U. S. Treasury Department. The industry is requested to review the contents of the proposed specifications and forward any comments or suggestions regarding the general satisfactoriness of the specifications to Mr. Fleisher, c/o Bureau of Ships (336) Navy Department, Washington 25, D. C. The new insecticide proposals, when promulgated, will govern Federal procurement of these commodities. Additional copies of the drafts from which the following summaries have been prepared are available from Mr. Fleisher. In order that a compilation of industrial comment may be presented for approval at the next meeting of the subcommittee, it is necessary that industry comments be submitted by September 15, 1947.

The proposal for DDT (dichlorodiphenyl - trichloroethane) allows two grades as specified in the contract or orders: Grade A—DDT, Aerosol, and Grade B—DDT, Technical. Each grade shall comprise 2,2 - bis(p-chlorophenyl) - 1 1,1 - trichloroethane, free from added modifying agents; and shall comply with the detailed requirements as summarized in the following:

The physical and chemical properties shall conform to the requirements specified in the accompanying table:

Property	Grade A Min.	Grade A Max.	Grade B Min.	Grade B Max.
Setting point, °C	—	—	89	—
Melting point, °C.	103	—	—	—
Organic chlorine, %/wt.	49.5	50.5	48	51
Ash content, %/wt.	—	0.05	—	0.5
Water insoluble, steam volatile material	—	(1)*	—	(2)*
Chloral hydrate, %/wt.	—	0.025	—	0.025
pH by distillation	—	—	4.5	8.0
pH by extraction	5.5	7.5	5.0	8.0
Water soluble matter, %/wt.	—	0.05	—	0.25
Cyclohexanone insolubles, ml	—	—	—	0.2
Monofluorotrichloromethane insoluble, ml.	—	0.01	—	—

Grade A—aerosol—shall be a fine white crystalline powder, free-flowing and without lumps. Grade B —technical—shall be a fine to medium granular powder with a white to cream color.

The proposal specifies with regard to markings that each container of DDT be marked in compliance with existing Federal laws and also contain the following word of caution: "DDT is toxic and when in solution can be absorbed through the skin. Avoid inhaling dusts, and mist from sprays. Avoid contamination with foodstuffs."

Purchases will be made on the basis of *lot acceptance* tests and *production* tests, which involve a series of samplings, inspections and tests from time to time as will be outlined: The government inspector shall select a suitable sample from each lot for the following lot acceptance tests to be run at the place of manufacture: setting point, melting point, ash content, determination of pH by extraction, and determination of monofluorotrichloromethane insoluble material. Details of the tests are given in the copy of the proposals which may be obtained as mentioned earlier in this summary. Regarding sampling procedure for production check tests, the proposal states that from the first lot offered for delivery under a contract or order, and from every 60 lots thereafter or at intervals of 30 days, which ever is the more frequent, the inspector shall take at random a one-pound sample, which shall be sent to a government laboratory designated by the bureau or agency concerned for the tests as already specified. The following tests will be run for production checking: Setting point, melting point (Thiele-Dennis), organically-bound chlorine, ash, pH by distillation and by extraction, water-insoluble, steam volatile material, chloral hydrate, water soluble material, cyclohexanol insoluble material, monofluorotrichloromethane insoluble material.

It is noted that the proposed DDT specification is based on joint Army-Navy specification JAN-D-56a and includes several improvements in test methods.

THE proposal for a liquid, water-emulsifying insecticide concentrate of DDT, a non-explosive solvent, and an emulsifying agent states that the concentrate shall consist of at least 25.0 percent (wt/vol) of DDT, (conforming to the requirements for grade B as stated in the first proposal mentioned in this summary) an emulsifier in such concentration as will enable the concentrate to meet the requirements of the specification, and a suitable solvent. Each bidder, in most cases, will be expected to submit with his proposal a one-gallon sample.

The concentrate shall be clear, homogeneous and free from particles of undissolved DDT crystals or foreign matter. The appearance of the concentrate shall not be affected when examined visually by transmitted and reflected light for clarity, homogeneity, undissolved or foreign matter. The visual test shall be repeated after storage for 24 hours at 32° F., seeding with a crystal or two of purified DDT, and restoring at 32° F. for one week. The concentrate shall contain a minimum of 120 mg of chlorine per ml (as determined by a volumetric silver nitrate test) and show not more than 5 ml of separation when tested in an emulsion stability test at 80° F., or more than 10 ml. of separation when tested at 120° F., 30 minutes after formation and after reformation. In this test, the stability of the concentrate is measured in a 1:4 dilution with hard water containing chlorides of calcium and magnesium. The concentrate must

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INDUSTRY NEWS

A. I. F. Meeting Planned

Plans for the 14th Annual Convention of the Agricultural Insecticide and Fungicide Association are well under way, according to Lea S. Hitchner, executive secretary of the organization. The meeting, to be held at the Essex and Sussex Hotel, Spring Lake, N. J., is scheduled for September 2, 3 and 4. The first day, Tuesday, is to be devoted to meetings of committees and the board of directors. On Wednesday the convention proper will open with talks by association president George F. Leonard, of Tobacco By-Products and Chemical Corp., Louisville, Ky., and by Mr. Hitchner. Other speakers that day are to include Dr. P. N. Annand, chief of the Bureau of Entomology and Plant Quarantine, Washington; Dr. George C. Decker, of the Illinois Natural History Survey, Urbana, Ill.; Harry Reed, chief of the Livestock branch of the product and marketing division of the U.S. D.A.; and W. G. Reed, chief of the insecticide division, livestock and meats branch, Office of Marketing Services, U.S.D.A. Also to be featured on the Wednesday program is a symposium with a question and answer period, covering problems of basic supply manufacturers, those who maintain national distribution, and regional mixers and blenders.

The last day of the meeting will include reports by the membership and information committee, the traffic committee, and technical committee. Speakers of the day will include Maurice H. Lockwood, president of the National Fertilizer Association, Washington; Dr. Charles L. Smith of the A.I.F. Association; Harry Babcock of the Federal Trade Commission, and James Watson, editor, New England "Homestead."

•

London Chemical Congress

Over two thousand chemists attended the world-wide, eleventh International Congress of Pure and Applied Chemistry held in London, July 17 to 24. Official delegates appointed to the congress numbered 1600, mostly representing Great Britain, France, Italy, U. S. A., the Scandinavian countries and Switzerland. A number of papers of interest to those in the agricultural chemicals industry were presented. In the field of plant nutrition and fertilizers were: "Application of Artificial Culture Methods to Problems in Plant Nutrition" by D. I. Arnon, U. S. A.; "Studies in Magnesium Deficiency Control in Quebec Apple Orchards," H. Hill and F. B. Johnston, Canada; "Fertilizer Ammonium Sulfate Crystals," J. Manning, United Kingdom; "Placement of Mineral Nutrients in Soil," A. B. Stewart, U. K.; "The Study of Mineral Nutrition of Plants by Plant Analysis, Plant Injection and Measurement of the Effect of Curative Treatment," W. A. Roach, U. K.

In the field of agricultural and soil fertility chemistry were: "Effects of Certain Organic Metabolic Products on Plant Nutrition and Growth," J. Audus, U. K.; "Assessment of Minor Element Deficiencies in Plants and Animals," H. R. Merston, Australia; "Trace Constituents of the Soil," R. I. Mitchell, U.K.; "Kinetics of Biological Oxidations in Soil," J. H. Quastel, U. K.; "Equilibrium Concentration of Cations in Soil Solutions," R. K. Scholfield, U. K.; and "A Microbiologist Looks at the Soil," S. A. Waksman, U. S. A.

A number of papers on insecticides, disinfectants, and fumigants were presented, among them being: "Toxicity of DDT," G. R. Cameron; "Toxic Organic Compounds Containing Fluorine," B. C. Saunders; "Modern Insecticides," F. P. Coyne, E. Holmes & J. S. Steward; "The Mode of Action of DDT on Insects," P. Lauger; "Physico-chemical Factors Involved in the Large-Scale Applications of DDT and their Significance in Connection with Insecticide Research," W. A. Waters; and "Use of a New Class of Quaternary Ammonium Disinfectants," J. C. L. Resuggan and J. G. Davis.

Andrew Reid and Colin Wintle were joint press officers for the 11th International Chemical Congress, 11 Garrick St., London, WC-2.

•

Ohio Lime Conference Held

The National Lime Association held a closed meeting at Wooster, Ohio July 9 and 10. Some 25 persons were present, including graduate fellows, staff representatives of each of the five participating stations, officials of the National Lime Association, and some representatives of the Association's member companies and members of the U.S.D.A. The first day's program was a round-table discussion of liming problems in

Coming Meetings

Agricultural Chemicals wishes to publish the meeting date and place of any gathering concerned with manufacturing, distribution, application or discussion of chemicals for agricultural use. Information of such meetings is solicited.

23rd Annual meeting, National Shade Tree Conference, Cleveland, Ohio, August 18-22.

Agricultural Insecticide & Fungicide Association, Fall meeting, Spring Lake, N. J., September 2, 3, 4.

Fertilizer Chemistry Division, A.C.S., Sept. 14, New York.

15th Annual Convention National Pest Control Association, Bellevue-Stratford Hotel, Philadelphia, October 27, 28, 29.

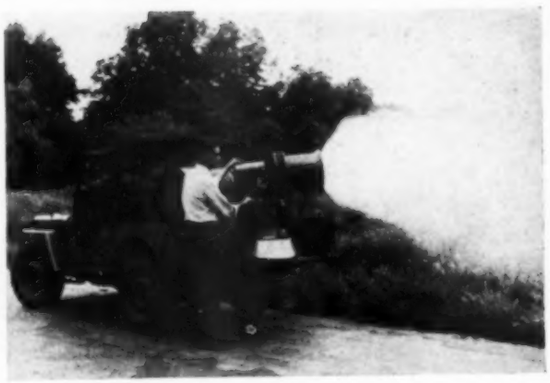
Pacific Chemical Exposition October 21-25, San Francisco.

National Fertilizer Association Fall Meeting: Atlanta, Ga., Nov. 10, 11, 12.

American Association of Economic Entomologists (In conjunction with meeting of American Association for Advancement of Science,) December 26-31, Congress Hotel, Chicago, Ill.

Exposition of Chemical Industries New York, December, 1947.

general. No prepared papers were presented, but members of the group discussed informally numerous questions taken from a previously prepared list. The second day's program consisted of a conducted tour around the station, and formal reports of research fellows. Dr. Garth Volk, chief in agronomy at the Ohio Station, acted as chairman of the conference. Participating in the conference were the Ohio, Pennsylvania, Maryland, New Jersey and New York experiment stations.★★



Hession Microsol Corp., Darien, Conn., has recently reached commercial production on the "Field Microsol," Model 403. The device produces extremely fine aerosols which will drift for a half a mile or more, as well as heavier type mists. It is compact and light in weight (less than 200 lbs) so it may be transported in light vehicles. The aerosol is produced by centrifugal force, acting through a high speed multi-disc rotor which films the liquid insecticide to ultra-microscopic fineness. A blower serves to diffuse the aerosol thus formed in the desired direction. The unit is mounted on a universal action base, permitting 20° elevation and 360° rotation. Its capacity when using an insecticide of light oil base ranges up to 160 gallons per hour. The particle size is a nearly direct function of the valve opening. The makers of the device say it can be closely controlled as to uniformity, and that particles as low as 10 microns can be readily produced. The device was first developed for use in mosquito control, but has also proved practical for the spraying of herds of cattle and in insect control in orchards. Other specific applications are being investigated.

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VERMONT

"1068" Rushed to West Coast

Velsicol Corporation, Chicago, recently rushed quantities of its chlordane product "1068" to Oregon to halt an infestation of Mormon beetles which were attacking crops in the Columbia River area. According to A. R. Jameson, executive vice-president of Velsicol, the initial shipment of "1068" brought favorable results, and additional supplies of the material were ordered in readiness for further infestations. The product, "Velsicol 1068" is a chlorinated camphene to which the Department of Agriculture has given the generic name of chlordane.

•

R & H Lowers "Triton" Price

Rohm & Haas Co., Philadelphia, has announced a reduction in the price of its product "Triton B-1956," a resin type emulsifier used as a spreading, sticking and flocculating agent in agricultural insecticides. The latest price reduction, the second within two months, amounts to 45c per gallon in the manufacturer's and distributor's price. The company explains that economies in production and the settling down of raw material costs following the end of ceiling prices have made possible the lowering of price schedules.

J. Vernon to New Position

Jack Vernon, Medina, N. Y., has been named vice-president and general sales manager of the Niagara Chemical Division of Food Machinery Corporation, Middleport, N. Y. The new appointment is effective as of September 1, 1947. Mr. Vernon has been employed by Niagara since 1922. He was a salesman for ten years, a district sales manager for 5 years, and since 1937 has been assistant general sales manager. He is a graduate of Mississippi State College. The appointment of Mr. Vernon was made at a meeting of the board of directors June 13, which also named Joseph B. Cary to the position of executive vice-president, and Ernest Hart as manager of Niagara and a vice-president of the parent company as reported in July *Agricultural Chemicals*.

DDT SPECIFICATIONS

(*Continued from Page 50*)

not show any residual stain and only a mild residual odor when tested on bleached cotton sheeting as indicated in the proposal. Initial point in the distillation range shall be not less than 300° F., and an end point not higher than 550° F. is specified. The insecticide concentrate shall cause no more than a slight discoloration of mild steel strips in an insertion test and shall cause no crazing or softening of strips of polymethyl methacrylate plastic.

The markings shall include proper identication, precautions regarding toxicity, mixing instructions, and directions for use as a residual spray.

Directions for use of the concentrate are thought to be of interest to the readers of this summary and are therefore included in detail: "For control of flies, roaches, and mosquitoes, mix 1 part of insecticide-concentrate with 4 parts of water and apply at the rate of 1 quart per 250 square feet of walls, ceilings, floorboards, crevices, and other surfaces where the insects congregate, and other premises where use of a water-base insecticide spray is permissible. Remove or cover food, drinking water, cooking utensils, etc., before spraying.

Use a coarse spray which gives good wetting. When so used, spray is effective in the control of flies, roaches, and mosquitoes for a period of 6 to 8 weeks unless removed as by weathering or washing."

The proposed DDT-Emulsion concentrate specification was based upon Navy Department specification 51-I-19, which incidentally, will still be used for Navy procurement of this commodity, since the Navy Department requires prior approval of prospective bidders for DDT-emulsion concentrate contracts.★★

GUEST EDITORIAL

(*Continued from Page 16*)

About 1883-85 it was found that the phosphorus in open hearth basic slag, when finely ground, is largely citric-acid-soluble and gives good results when applied to porous and calcium - deficient soils and meadow lands, but does not do well on heavy, limey ground. In 1897-99 Wolters, a German chemist, fused together raw phosphate, coal, sand, and either sodium or potassium sul-

TRIED-AND-PROVEN

DDT Formulations by Geigy Company

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GESAROL* Compositions for Sprays and Dusts on Plants.

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When you sell Geigy GESAROL and NEOCID Insecticides, you sell satisfaction through scientific achievement. These DDT compositions were first in the field. Nation wide, their efficiency has been demonstrated by producers of truck crops, field crops, fruits, cattle and dairy products.

Suggestions for their use are based on eight years of continuous experience in the compounding and application of DDT insecticides. There are some good territories still open for Distributors. Write or wire us now.

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*Reg. U. S. Pat. Off. Insecticidal Compositions containing DDT are covered by Reissue Patent No. 22,700.

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ORIGINATORS OF DDT INSECTICIDES

phate, in an effort to prepare an alkaline phosphatic fertilizer. However he abandoned the effort because of the powerful solvent action of the molten alkaline phosphate on the furnace lining. The product, which was soluble in citric acid and carbon dioxide water, gave field results equal to superphosphate. In 1911-12 the Rhenania Company developed a method of manufacturing basic phosphate pyrochemically. They avoided Wolters' difficulties by calcining in a cement type kiln intimate mixtures of raw phosphate, limestone and alkali silicates at a sintering, not a melting, temperature, producing a citrate-soluble basic phosphate conserving the lime potential.

During the later years of World War I the Germans made a large tonnage of this material, using French Somme phosphates. In the early thirties two of my colleagues, chemical engineers, inspected one of their plants on the Kiel Canal which began production in early 1918, but they were not greatly impressed. Last August two army engineers inspected the plant. They made an interesting report. The alkali used was soda ash, and the annual output was 100,000 metric tons. The product analyzed from 23% to 29%, depending on the grade of rock used. It sold in Germany at the same unit price as superphosphate. The process requires careful control and operating experience, and was considered successful under German conditions. Analysis of the product reported by the army engineers shows 2.19% fluorine in a 28% soluble calcine.

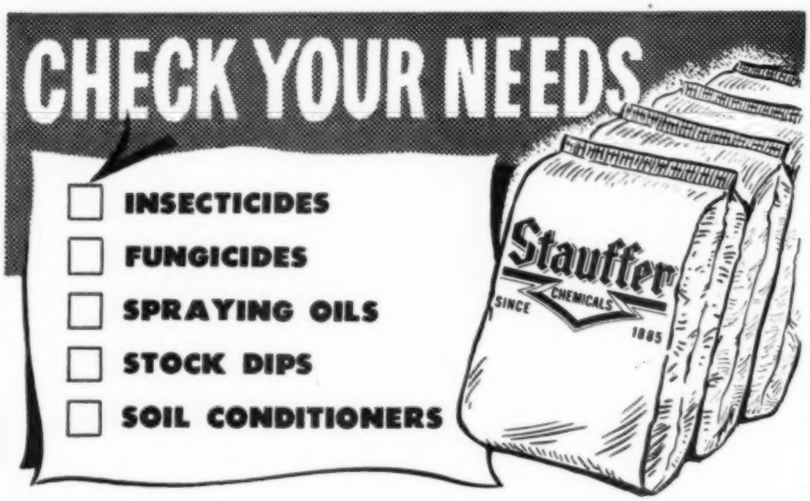
In 1919 our Tennessee Chemical Company attempted to demonstrate a similar process developed by Mr. Ellis Soper, and the results were not satisfactory. Herbert Meyers, our senior fellow at Mellon Institute, then took over the problem. He found that the culprit was fluorine, its removal the interrogation point. He finally succeeded in removing the fluorine and operated a small pilot plant, producing a 32% available product with one tenth of one percent of fluorine.

Work has been conducted by other American companies, but it seems to be a discouraging task. The Coronet Phosphate Company has been operating a kiln at Plant City for some time. The TVA has given considerable publicity to its fused phosphate operations. There is need, in my opinion, for a basic available tricalcium phosphate in which the calcium potential is available, for use on pasture lands and on high acid calcium-deficient soils.

I would like to see the fluorine in superphosphate reduced materially. It averages one and four tenths percent. The element possesses rare ability even in trace to render calcium phosphate insoluble. It may explain in part why growing plants utilize such a small percentage of the applied phosphate. In any event I do not like to see so much fluorine plowed into the soil year after year.

The rock is being better processed in the phosphate fields than it was in my earlier years. Oil flotation has practically doubled Florida's phosphate reserves.

I have always been intensely



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Staffer also offers a complete line of insecticides . . . DDT, Rotenone, Pyrethrum, Cryolite, etc., blended with inert carriers or combined with Sulphur for either spraying or dusting.

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interested in sources of supply of fertilizer materials. During my time there have entered the nitrogen supply field cyanamid, by-product sulphate of ammonia, aqua ammonia, and the Haber-Bosch synthetic nitrogen process. I have personally inspected the German nitrogen plants, and in their day met Prof. Doctor Fritz Haber and Doctor Carl Bosch. In 1906 and again in 1909-10 I inspected the German potash mines, and in 1919 the French mines. I was in on the discovery of alunite at Marysvale, Utah, and winning potash from that source during the first world war. Aside from the nitrate of soda fields in Chile I think I have visited practically all of the chief sources of supply of agricultural chemicals.

One of our innovations in which I took great pride was the development of direct ammoniation in late 1926. Later I patented the use of a solution of anhydrous ammonia and ammonium nitrate, now so largely used by the trade. My patent claimed that the mixture could be handled with greater safety than ammonium nitrate, by lowering the vapor pressure. Another development we worked out during the last months of World War I was a vanadium alumina catalyst for making contact acid—the first. This was a joint patent shared by Herbert H. Meyers and myself. A pilot plant was successfully operated alongside one of our chamber plants at Nashville, at Armistice.

There has been great progress. There will doubtless be greater progress. I shall follow it all with much interest.★★

PACIFIC SLOPE

(*Continued from Page 44*)

annually; during the war few acres were fumigated because of the labor situation, but this past season probably 50,000 acres were again fumigated. Seven and eight ounce U. S. Army duck and 250 drill are the fabrics used in making fumigation tents at the present time and for the past 40 years. This past year a nylon tent was made available for use in citrus fumigation.

Its advantages are lightness of weight, resistance to mildew, greater strength against tearing, and a smooth hard finish. The porosity of the nylon tent can be altered by changing the weave or by calendering or pressing the woven fabric.

Dr. Walter Ebeling, University of California, Los Angeles, spoke on the subject "Avocado Pests and Their Control." The avocado, over a period of years, has gained its full complement of pests. The importance of these changes from time to time. Latania scale, which formerly was the No. 1 pest, is now controlled by predators. Greenhouse thrips, which was a minor in former years, is now the No. 1 pest. It is very difficult to spray avocados. Greenhouse thrips are amenable to a combined 5 percent DDT and 80 percent sulfur dust, applied in July, and possibly 6 weeks later if the situation warrants. Never more than 3 p.p.m. DDT has been found on the surface or in the meat. June beetles will defoliate the avocado, but 5 percent DDT dust is effective in its control.★★

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In addition to meeting the basic requirements of the above methods, this apparatus incorporates a number of unusual features which contribute materially to ease of handling and assist in procuring accurate results. One of the most serious difficulties in running crude fibre determinations is frothing of the solution in the beaker. This results in loss of sample, which distorts quantitative calculations. The non-frothing performance of the "Precision" digesting system is vitally important to accurate work. Write for literature No. 6-32-33 –O

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FUMIGATION METHODS

(*Continued from Page 46*)

tions of the dichloropropene mixtures are reported as giving a considerable degree of weed control.

Carbon disulfide has been used to a limited extent as a soil fumigant for many years. In this capacity it is slightly to moderately fungicidal and fairly effective against many soil inhabiting insects and most nematodes, but the fumes are exceedingly inflammable and carbon disulfide is being replaced as a soil fumigant by other materials comparable in cost, equally effective, and less hazardous to handle.

Water solutions of formaldehyde (formalin or formaldehyde solution) are used to some extent for treating potting soil in small quantities or seed beds of small size. Formaldehyde is effective in controlling many fungi, including those causing "damping off" of seedlings but it is not very effective against the root-knot nematode. The fumes do not diffuse very freely and formaldehyde in solution is usually mixed with the soil mechanically or applied to the surface as a drench.

Uramon (urea) and cyanamid (calcium cyanamide), two nitrogenous compounds used in the fertilizer trade, are available in powdered or granular form and when properly applied and mixed with the soil the combination is effective in killing the root-knot nematode, fungi, and weed seed.

Large-Scale Soil Fumigation

Soil fumigation has become a regular practice in the pineapple fields of Hawaii and is becoming so in California and other western states where many thousands of acres are treated annually. Dichloropropene mixtures and ethylene dibromide are the fumigants used and a greater part of this area is treated primarily for controlling one or the other or a combination of two major pests: the root-knot nematode and wireworms.

Large-scale applications are made with power-driven applicators of the continuous-flow type that deliver into the soil from 6 to 10 streams simultaneously or with attachments to plows that place the chemical in the bottom of the furrow just in front of the moldboard where it is immediately covered. Applicators consist of a tank to hold the fumigant and a system of tubes to convey it into the soil, the tubes passing down the back edge of narrow cultivator teeth sometimes referred to as chisels. One or more pumps are included in the mechanism and the liquid is delivered under pressure.

Applying fumigants on a large scale is usually done on a custom basis by individuals or companies owning power equipment. Anyone interested in large-scale operations should make contact with representatives of the companies that produce dichloropropene or ethylene dibromide products.★★

INSECT CONDITIONS

(*Continued from Page 45*)

were reported with various concentrations of hexaethyl tetraphosphate

Sabacide

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and tetraethyl pyrophosphate, applied with a fog machine.

The two-spotted spider mite was appearing on hops in central Washington the first week of July, which was earlier than usual, and the infestations increased in some districts toward the middle of the month.

Codling moth adults of the spring brood had practically completed emergence by the end of June in eastern New York, central and southern New Jersey, southern Indiana and southern Illinois. There have been no reports of serious injury.

Infestations of the European red mite were on the increase in orchards in western New York and New Jersey toward the middle of July. At that same time this mite had reached destructive levels in scattered orchards in southern Indiana and, together with the Pacific mite, it was becoming serious in Yakima Valley of Washington where orchards with brown or bronzed foliage were evident.★★

GLADIOLI INDUSTRY

(*Continued from Page 35*)

considerably. This disease exhibits itself by producing reddish brown spots or long streaks of various sizes. These spread to the flowers and result in large losses particularly during warm spells, upon arriving in the North. No specific treatment has been found. If this disease appears as a storage rot the corms may not have been sufficiently cured. To prevent

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this, thorough curing and cleaning together with dry cool storage of the bulbs is necessary. Investigations are under way to treat the bulbs after digging and drying, to check diseases.

The digging, cleaning, curing and storing of the bulbs all present problems to the growers. After the bulbs have been cured it is customary to place them in cold storage during the summer months in Florida. This is the best method before breaking for dormancy. Chemical treatment, however, is necessary at times. For this purpose ethylene chlorhydrin is used. This procedure injures certain varieties unless the bulbs are really dormant. As yet the best concentration and working periods are not properly worked out. One gallon of anhydrous ethylene chlorhydrin in 75 gallons of water is quite safe. The bulbs are soaked in this solution for ten minutes, covered for two days and then given the "Ceresan" treatment as usual.

This newer crop for Florida has attracted considerable attention by purveyors of insecticides and fungicides. It is a fertile field for investigations.★★

Acknowledgements—Credit is due to Dr. D. B. Creager of Terra Ceia Island Farms, Palmetto, Florida, for general information and photographs; to Mr. L. E. Bissell and Mr. John Diem of Southern Agriculture Insecticides for details regarding the extent of the industry and to Dr. Robert O. Magie, in charge of gladioli research at the Bradenton Vegetable Crops Laboratory for his "Summary of Experiments on Gladiolus," as well as communicated information.

2, 4-D

(*Continued from Page* 27)

of the area will be treated with other chemicals, but that figure will give a rough idea of the magnitude of this situation when it is projected into the fairly-near future.

What are the places where 2,4-D or other, newer, herbicides may be used? At present, the biggest prospective use is to destroy annual weeds in grain fields. Already both 2,4-D and some dinitro compounds are being sprayed on considerable areas of grain. The chances of this being done on a large scale have been greatly increased recently by the development of low-dosage spraying equipment that will use as little as 10 gallons of water per acre. Water is the most serious bottleneck in many kinds of weed control with chemicals, and the perfection of this new water-saving machinery, is regarded as being of the greatest importance.

There should be a tremendous use of 2,4-D for treating roadsides, ditchbanks, railroad rights-of-way, transmission lines, fire lanes, and other large areas that should be in permanent stands of grass with no weeds.

The use of 2,4-D on lawns has, of course, received wide publicity, but this is likely to be a self-destroying business. Once the weeds are out of the lawn it takes very little chemical to keep them out thereafter. To a certain extent the same is true of any sales made for use on permanent turf.

One of the serious weed problems, both in the United States and in other countries, is that of brushy or shrubby plants which take over vast areas of pasture and range lands. Texas has tens of thousands of acres of what was once fine grazing land, now completely overgrown with mesquite, cedar, and other worthless shrubs. Sage brush on the western plains also takes its toll. Many agencies are working to develop methods of eradicating this growth and reopening the land for grazing, and it is possible that chemical application by airplane will be the answer.

In the west, too, are thousands of miles of irrigation and drainage ditches. Maintenance of these ditches is a costly item, made more so by the heavy stands of weeds, willows, and other brush that grow up along the banks. Already it has been found that 2,4-D is very helpful in reducing this vegetation, and there is a fine market there for those who can exploit it. Certain specific weed plants need attention and 2,4-D seems to be the answer. Ragweed, which causes hayfever, is thoroughly disliked by millions. The city of New York is already undertaking such a project with 2,4-D.

Perhaps one of the most significant developments in recent months has been the finding that 2,4-D can be spread on the soil immediately after planting corn without injury to the corn and with elimina-

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HEXAETHYL TETRAPHOSPHATE

The amazing new insecticide for control of Aphids, Spider Mites and many other insects.

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Since 1926
Agricultural Chemicals Specialists

Manufacturers
of
ORGANIC
CHEMICALS

2, 4-D

2, 4 Dichlorophenoxyacetic Acid
and
Sodium Salt

★

DDT

Dichlorodiphenyltrichlorethane

★

KOLKER CHEMICAL WORKS
80 Lister Avenue Newark 5, N. J.

tion of most of the weeds. If further tests bear out these preliminary findings, this will be a truly revolutionary idea, for it would relegate to the scrap heap hundreds of thousands of corn cultivators and bring to fruition the long cherished dream of growing corn without having to cultivate between the rows.

There are many other places in which 2,4-D can be used, but this material is not the only herbicide coming over the horizon. Isopropylphenyl carbamate gives promise of being an antonym, or opposite of 2,4-D. That is, it takes out grasses and leaves the broad-leaved plants. Special petroleum oils, having a high content of the aromatic constituents have a fine opportunity to help us with Johnson grass, Bermuda grass, and all the other weedy grasses, especially if "fortified" with one of the dinitro compounds. They should enjoy large sales. The dinitros themselves, of which there are now four or five kinds on the market, have their own fields of usefulness though they compete with 2,4-D to some extent.

The fact is that the surface has been only scratched in testing organic compounds as herbicides. Inorganics have probably run their course, but we have a long way to go with the other group. It is true that the extensive series of tests made during the war by the Biological Warfare Service indicated that 2,4-D is still the best of more than 1600 related compounds tested by the Army. The Army's tests, however, were small-scale laboratory experiments and do not necesarily eliminate some of these compounds from consideration. Outside of the growth regulators, there is still an enormous number of possibilities, any one of which may find some specialized use in weed control.

It may be that before many years specialized weed-killing chemicals will be used in the same way that specialized insect and fungus-killing materials are utilized. This is rather unfortunate for the consumer because he is already faced by a large number of compounds with confusing names. This is a situation that needs attention. An umpire is needed, or at least a clarifier to keep these matters straight before the public. It will be unfortunate from the public point of view if the confusion becomes worse. Persons in official circles can hardly expect commercial interests to do this job, but there is no machinery at present available for any one else to do it.

This, then, is a sketchy outline of the future of chemical weed killing as it appears to those concerned with the long range view. It is a new business with a fine future, but it is a future for specialists. The days are passing when any one with a packaging machine and a source of supply of chlorinated benzene can go into the market with a weed killer. But, for those who are willing to study the market and make some effort to become specialists in this field and, above all, who are capable of saying "No" to some of their own pet ideas, there is a bright day ahead in this field.★★

At Your Service

Coincidental with the celebration of our 25th year of service to the agricultural and industrial chemical trade, we announce the opening of our new warehouse and plant at Hicksville, Long Island.

Almost 40,000 square feet of well planned storage space enables the maintenance of adequate stocks of all materials. Direct railroad siding and ample platform facilities for truck deliveries and pick-up assure speedy handling and dispatch of all orders. A special department for repacking into small containers of materials heretofore available only in bulk is designed to satisfy a long-felt need of many customers.

Adequately staffed with experienced personnel aided by modern loading equipment, these new facilities will enable us to satisfy every reasonable demand of the clientele which we service in the New England and Middle Atlantic States.

Micro Nu-Cop

For the control of Potato and Tomato Blight. A fixed neutral insoluble Tri-basic Copper Sulphate containing 53% metallic copper for dusting or spraying. No lime required—extremely fine particle size, 2-5 microns.

●

AVAILABLE
From One Source

A complete list of agricultural products for the dealer backed by a quarter century of experience in serving the industry:

INSECTICIDES SEED PROTECTANTS
FUNGICIDES FERTILIZERS
FEED STUFFS WEED KILLERS
And Allied Materials

FAESY & BESTHOFF, INC.
220 East 42nd Street, New York 17, N. Y.
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Plant and Warehouse: HICKSVILLE, L. I.

DDT

AVAILABLE FOR PROMPT SHIPMENT

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for

MONTROSE CHEMICAL CO.

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R. W. Greeff & Co. Inc.

10 Rockefeller Plaza New York 20, New York

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Want to make Chlordane water soluble? Griffin TREX 80 does the job! Bringing new organic toxicants out of the test tube and into proper form for practical, low-cost field applications is a job for

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The Most Widely Used

PYROPHYLLITE

in the agricultural field

is

PYRAX ABB

The tremendous and increasing tonnage sold each year reflects the confidence of entomologists and plant pathologists in our product.

Literature and samples on request

R. T. VANDERBILT CO., INC.

Specialties Department

230 PARK AVENUE, NEW YORK 17, N. Y.

FERTILIZER MACHINERY

(*Continued from Page 24*)

determining feasible machine designs to satisfy all of the requirements. In order to provide adequate current information upon which the designs of the various machines can be based, a large volume of research is needed. In view of the importance of developing suitable machines to enable the farmer to control properly the final placement of the fertilizer in the soil, it is essential that all of the fertilizer distributing machinery manufacturers and engineers keep abreast of the activities in the related fields. Likewise other agencies concerned with fertilizers should be similarly informed.

The nature, complexity, and extensiveness of the fertilizer application problem calls for close collaboration and cooperation of all agencies concerned. Further expansion of the present joint efforts on placement and allied problems should insure more rapid progress toward the ultimate and common objective of insuring the maximum efficiency in the use of commercial plant food.★★

SOIL FUMIGANTS

(*Continued from Page 31*)

Discussion

IN certain tomato greenhouses in New York State where fumigation has replaced much of the steam treatment of ground beds, experience indicates that fumigation benefits may be somewhat cumulative up until the 3rd or 4th year. Making two treatments a year using chloropicrin in summer, when soil temperatures are high, and a methyl bromide fumigant in the winter is becoming more popular. A crop of radishes or beet greens seems to be among the best to follow immediately after treatment as these are shallow feeders and tolerant of small residues.

With all soil fumigants it is important to follow directions with respect to care in handling, to preparation and after-treatment of soil, care of injectors, spilling on skin or clothing, having plenty of ventilation, etc. Like the handling of gasoline, electricity, and high explosives, there is a technique which, if disregarded, means danger, but if learned and adhered to makes soil fumigation safe. The tendency is therefore in the direction of building up service agencies with the latest equipment, training and experience to handle growers' fumigation problems on a custom basis with a minimum of capital expense. Such organizations have sprung up on the west coast, the gulf coast, and various other places. This makes the most efficient use of certain self propelled types of soil fumigation equipment.

If one does not expect miracles from them and is willing to look on them as cheap substitutes for steam and if he follows directions and doesn't skimp on dosage, they will often fill certain needs in a very satisfactory manner. This is especially true in regard to nematode and wireworm control, both inside and out of doors, and in the disinfesting of seedbed, potting, and plant bed soil.★★

EVERLASTINGLY AT IT!.....

Black Leaf

Yes, TOBACCO BY-PRODUCTS is everlastingly at it — developing products of vital importance to agriculture.

BLACK LEAF — a trademark embracing a comprehensive variety of nicotine-based products.

1. The FAMOUS BLACK LEAF 40—Used as a spray or dust in controlling small insects and plant lice. Also used to control external parasites of cattle, sheep and poultry—and as a drench for sheep.

2. BLACK LEAF 155—for cover sprays for codling moth.

3. BLACK LEAF POWDER AND PELLETS—for controlling the large roundworm in chickens.

4. BLACK LEAF 155 WITH DDT—for control of codling moth and certain other insects.

5. BLACK LEAF 10 DUST BASE—meets the demand for a non-alkaline neutral dust.

6. BLACK LEAF CUNIC DRENCH—for sheep and goats. Formula recommended by U.S. Dept. of Agriculture.

7. BLACK LEAF DRY CONCENTRATE—used either as a spray or base mixture with carrier for dusting.

THE "TOBACCO BY-PRODUCTS" LINE ALSO INCLUDES

8. MASH-NIC—for mixing with poultry feed to control large roundworm.

9. NICO-FUME LIQUID—for greenhouse work.

10. NICO-FUME PRESSURE FUMIGATOR—spreads fumes under pressure when ignited. Saves contact of hands with powder.

PROTECTION For The Farmer — PROFITS For The Distributor

TOBACCO BY-PRODUCTS & CHEMICAL CORPORATION, INCORPORATED
LOUISVILLE, KENTUCKY

Industry Patents

The following patents have recently been issued by the U.S. Patent Office on products and devices in the agricultural chemical field. Copies of the patents may be obtained at 25c each by addressing the U.S. Patent Office, Washington 25, D.C.

2,421,507. HORTICULTURAL SPRAY OIL. Patent granted June 3 to Paul R. Jones, Piedmont, Calif., assignor to Shell Development, San Francisco. A clear mineral oil horticultural spray containing dissolved a minor proportion exceeding its normal solubility in said mineral oil of rotenone and a minor but rotenone-solubilizing proportion of a mixture of polychlorinated alkanes and alkenes of from 3 to 4 carbons.

2,422,106. SANTONIN-PHENOTHIAZINE VERMIFUGE. Patent issued June 10, 1947, to Raymond E. Lubbehusen, Webster Groves, Mo., assignor to Ralston Purina Co., St. Louis, Mo. A vermifuge unit for administration to pigs of body weight in the range of 35 to 65 pounds to effect removal of ascarid worms, the ascaricide ingredients of said unit being approximately 1¼ grains of santonin and not less than 4 grams of phenothiazine.

Trade Mark Applications

FIDEL-X, in script lettering, underlined, for insecticide for control of termites. Filed Aug. 8, 1946, by Fidelity System, Inc., Newark, N. J. Claims use since April 13, 1946.

ISCOBROME, in sans serif capital letters, for soil fumigation. Filed Aug. 22, 1946, by Innis, Speiden & Co., New York. Claims use since June 30, 1944.

OMILITE, in heavy capital letters, for fungicides and horticultural spray adjuvants. Filed Aug. 23, 1946, by B. F. Goodrich Co., New York. Claims use since July 20, 1946.

NOXBLITE, in tall condensed capital letters enclosed in shadow line box, for fungicide for control of blight on potatoes, cucumbers, and tomato plants. Filed Aug. 26, 1946, by Emmett L. Fox, Brooks, N. J. Claims use since Aug. 15, 1946.

F-13, in heavy letters, for monochlorotrifluoromethane, used as a propellant. Filed Sept. 19, 1946, by Kinetic Chemicals, Inc., Wilmington, Del. Claims use since Dec. 13, 1945.

FREON-13, in capital letters, for monochlorotrifluoromethane, used as propellant. Filed Sept. 19, 1946, by Kinetic Chemicals, Inc., Wilmington, Del. Claims use since Dec. 13, 1945.

PICTURE OF COW, with skeletal structure illustrated in drawing, for commercial fertilizer. Filed Jan. 7, 1946, by Armour & Co., Chicago, Ill. Claims use since April 1, 1897.

SWIFT'S, in caps and lower case, for fertilizers. Filed Aug. 8, 1946 by Swift & Co., Chicago. Claims use since December, 1903.

DPT, in white capital letters within shaded circle, for liquid insecticides. Filed July 18, 1945, by Walter B. Jackson, doing business as Jackson Research Laboratories, Houston, Tex. Claims use since Sept. 18, 1944.

KNOX OUT, the letters K and O in solid black, and remainder of words in outlined letters, for insecticides in both fluid and solid forms. Filed Dec. 1, 1945, by Pennsylvania Salt Mfg. Co., Philadelphia. Claims use since Oct. 5, 1945.

MOTTIP'S, in capital letters, for insecticides. Filed Feb. 19, 1946, by Commanditaire Vennootschap Chemische Fabriek Rids, Ijmuiden, The Netherlands. Claims use since Jan. 28, 1938.

TOBISAL, in sans serif capital letters, for fungicide preparation. Filed May 25, 1946, by New York Quinine & Chemical Works, Inc., Brooklyn. Claims use since May 7, 1946.

Applications Granted

429,414.—INSECTICIDES. Filed May 31, 1946, by Pennsylvania Salt Mfg. Co., Philadelphia.

429,464. INSECTICIDE. Filed Nov. 4, 1946, by Shell Oil Co., Inc., San Francisco, Calif.

429,576. — MINERAL SOIL CONDITIONER FOR USE AS A FERTILIZER. Filed April 15, 1946, by Lodi Fertilizer Co., Lodi, Calif.

430,100. INSECTICIDES. Filed July 21, 1945, by Enoz Chemical Co., Chicago.

430,217. INSECTICIDES. Filed April 11, 1946, by General Chemical Co., New York.

430,224. RODENTICIDES. Filed April 15, 1946, by J. A. Stanley, doing business as Stanley Industries, Seattle, Wash.

430,225. PARASITICIDES . . . namely, insecticides, fungicides, germicides, herbicides. Filed April 16, 1946, by California Spray- Chemical Corp., Richmond, Calif.

430,226. PARASITICIDES, same as 430,225.

430,227. PARASITICIDES, same as 430,225.

430,228. PARASITICIDES, same as 430,225.

430,237. FUNGICIDES. Filed April 24, 1946, by U. S. Rubber Co., New York.

430,238. INSECTICIDES. Filed April 24, 1946, by U. S. Rubber Co., New York.

430,266. INSECTICIDAL WALL & SCREEN SPRAY. Filed May 13, 1946, by McCormick & Co., Inc., Baltimore, Md.

430,284. FUNGICIDES, INSECTICIDE, AND GERMICIDE. Filed May 21, 1946, by Imperial Chemical Co., Shennandoah, Ia.

430,346. PARASITICIDES. Filed June 28, 1946, by California Spray-Chemical Corp., Richmond, Calif.

430,347 and 430,348, same as 430,346.

430,377. CHEMICAL PRODUCTS FOR USE AS RODENTICIDES AND INSECTIVORICIDES. Filed July 25, 1946, by Monsanto Chemical Co., St. Louis, Mo.

430,410. TRIFLUOROMETHANE, USED AS A PROPELLANT. Filed Sept. 19, 1946, by Kinetic Chemicals, Inc., Wilmington, Del.

430,768. NATURAL FLORIDA PHOSPHATE FOR FERTILIZER. Filed May 1, 1946, by American Cyanamid Co., New York.

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 1st of month.

Entomologist: 30, MSc., Economic & Medical entomology. 4 yrs. Agric. Expt. Sta.; 4 yrs. U. S. Army Sanitary Corps. Desires research position in insecticide development and service. Address Box 167 care of *Agricultural Chemicals.*

Male Help Wanted: Top flight salesman—Age, 32-40, aggressive with following for territory management. Background heavy agricultural fungicide and insecticide bulk and package experience. Thorough know how of jobber and retail distribution. Technical knowledge desirable but not essential. Car allowance. Excellent salary plus override for proven men from major companies only. Resumes held in strictest confidence. Address Box 168 care of *Agricultural Chemicals.*

Entomologist: Young man with entomological training wanted by insecticide manufacturing organization with view of eventually moving into technical sales work. Location eastern seaboard. Give full record, salary desired, etc. Address Box 169 care of *Agricultural Chemicals.*

Chemist: Opportunity for young graduate chemist to start in laboratory of manufacturer of basic chemical specialties, including insecticides and herbicides. Outline education experience, and other details. Address Box 170 care of *Agricultural Chemicals.*

Chemical Investigations: Chemist specializing in compilation of literature searches for industrial organizations. If you have a project to be investigated in the literature, communicate with Box 171 care of *Agricultural Chemicals.*

For Sale: Various equipment including one Schultz-O'Neil 28" pulverizer mill, one Howes Auger Filler, one 20x 48 Rotex Screen, one Abbe OS Sifter, one Union Special Weighing Machine. Also tanks, kettles, etc. For further details, communicate with Box 172 care of *Agricultural Chemicals.*

ALVIN J. COX, Ph.D.

Chemical Engineer and Chemist

(Formerly Director of Science, Government of the Philippine Islands; Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)

ADVISOR ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS

Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.

1118 Emerson Street
Palo Alto, California

Dr. E. A. Back Retires

Dr. Ernest A. Back, entomologist, retired from the U.S.D.A. June 30, after more than 38 years of service. He has been in entomological work continuously since 1907. Dr. Back is an authority on control of insect pests in the household and storage fields.

•

Studys Chloropicrin

A study of chloropicrin is being carried on by Innis, Speiden & Co., New York. The material is being tested as a nematocide, fungicide, rodenticide and insecticide, the company states. Results of the experiments will be announced later.

•

Aero Supplies Equipment

Aero Dusters, Inc., 332 S. Michigan Ave., Chicago, has supplied the Guatemalan Government with a quantity of airplane dusting equipment for use against locusts which have been plaguing that Central American country's farmers. Shipment was made in a Guatemalan government plane, which came to Chicago for the load.

•

Correction

In the report of the National Fertilizer Association meeting in our July issue, a photograph of Dr. G. Scott Robertson was identified as W. T. Hart, who also appeared on the speaking program. We deeply regret the mistake, and apologize to the gentlemen involved.

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(The Advertisers' Index has been carefully checked but no responsibility can be assumed for any omission.)

"Did yo' all hab any particular bird in mind, Cuthbert?"

Flock Shooter?

A FLOCK shooter is a hunter who shoots at the whole flock and usually hits nothing,—instead of picking out one bird at a time. Flock shooters are like some advertisers who try to cover too many fields through one advertising medium, and who mostly fail to make a dent on any one. Specific and selective advertising, like correct shooting, usually pays off.

If, for example, you want to advertise to the field of agricultural insecticides, weed killers, fungicides and fertilizers, the most concentrated and selective circulation as well as maximum reader interest may be secured through the pages of

AGRICULTURAL CHEMICALS

254 WEST 31st STREET NEW YORK 1

TALE ENDS

How much do grasshoppers eat? The Wyoming Agricultural Experiment Station, Laramie, conducted a recent study to determine an answer to this question. A number of common range grasshoppers (*Aulocara elliotti*) were caged and their consumption of forage measured. When there was a population of 15 to the square yard, the insects consumed forage at the rate of 406 pounds per acre. When there were 25 to the square yard, the forage consumption was 489 pounds to the acre. At 35 to the square yard, the forage consumption rose to 792 pounds to the acre . . . an amount almost as much as the amount of forage normally produced each year on the mixed prairies of Wyoming!

•

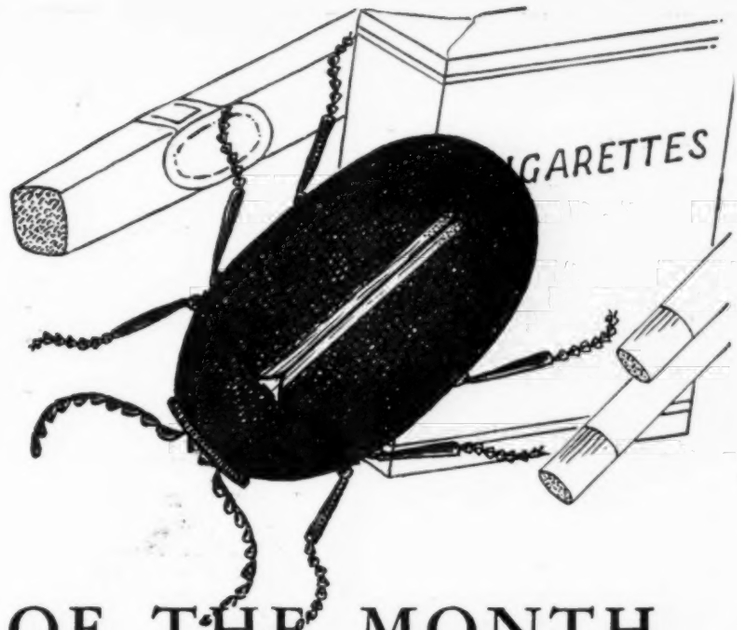
The protection of bees from various diseases is receiving the attention of entomologists in various parts of the U. S. In Missouri, sulfathiazole is being administered to bees to control American Foulbrood, a serious bee disease which takes an increasing toll annually. Heretofore, the only effective known method of control was to burn the bee colonies, hive and all. The U.S.D.A. is considering halting queenbee importations to the U. S. in an effort to stamp out Isle of Wight or acarine disease of bees which has threatened to wipe out the bee industry of England. Other European countries are also experiencing heavy bee fatalities because of the disease. The mite which causes the disease has never been found in the U. S., the Department of Agriculture says.

•

The Food and Agriculture Organization of the United Nations in its report on the mission for Greece recommends that the various county agents of Greece, in cooperation with the Soils Laboratory, carry out demonstrations of the principal soil types and with the main crops of their districts on the use of fertilizers to increase yields and improve quality of the crops.

CIGARETTE BEETLE

(*Lasioderma serricorne* Fabricius)



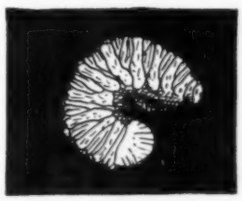
BUG OF THE MONTH

. . . controlled with Pyrethrum

THE cigarette beetle is typical of the many stored-product pests which can be controlled with complete safety through the use of pyrethrum insecticides.

This pest infests factories, warehouses, cigar stores. Wherever package or chewing tobaccos, cigars or cigarettes are stored, the tiny grubs or beetles happily work away, destroying valuable merchandise.

Here pyrethrum insecticides, completely harmless to humans, provide safe and sure control. The source of infestation is eliminated without complicated procedures, without affecting taste or odor, and without introducing poisonous residues into the product itself.



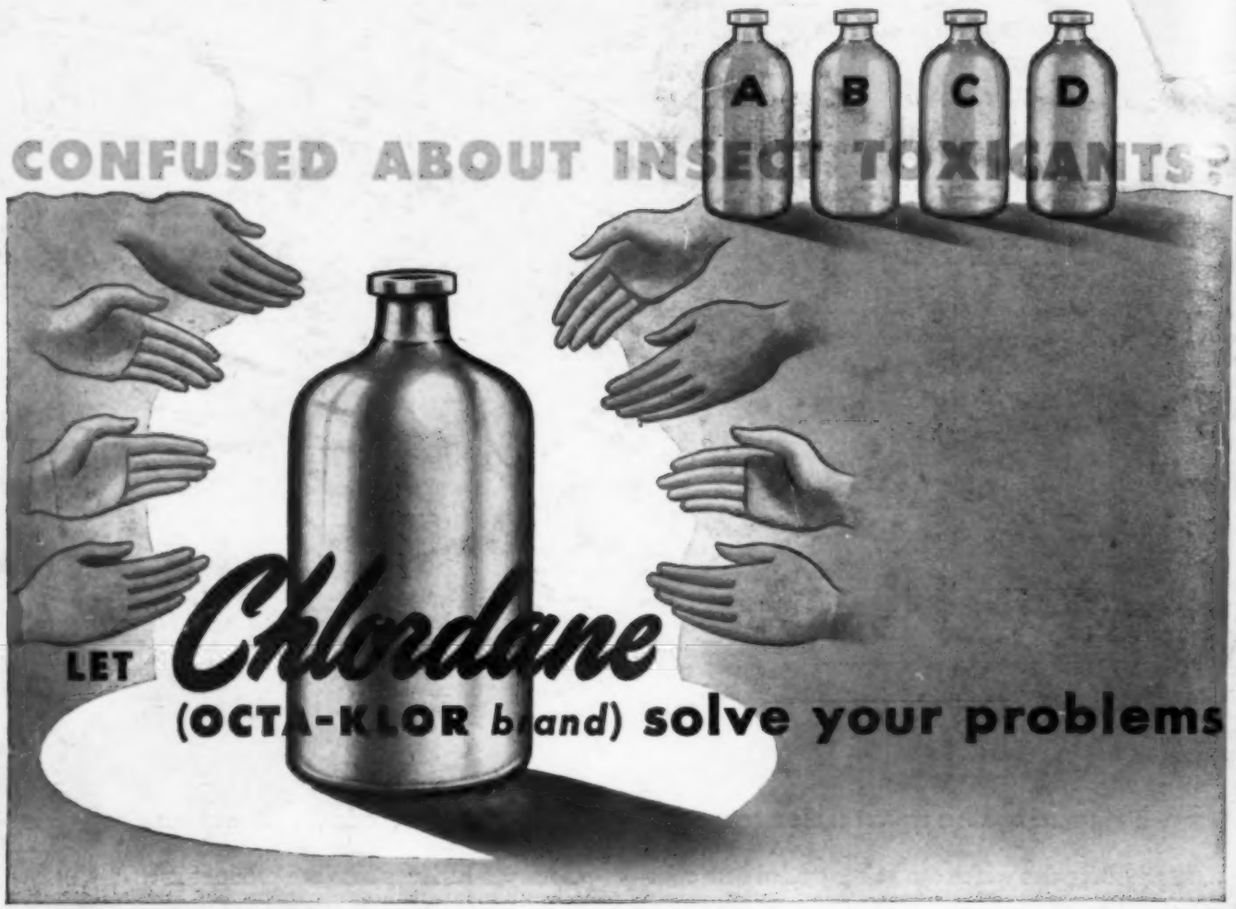
For this, as for most other stored-product pests from the confused flour beetle to the cheese skipper, Prentiss Pest-Tested Pyrethrum Products are ideally suited. Prentox Pyrethrum Powder or Prentox No. 20 Liquid Pyrethrum Concentrate are specially prepared for maximum results, maximum economy. These time-proved basic insecticides are at your service throughout the year. Write for samples and quotations.

R. J. PRENTISS & CO., Inc.

110 WILLIAM STREET, NEW YORK 7, N. Y. 9 SO. CLINTON STREET, CHICAGO 6, ILL.

PRENTOX PEST-TESTED CONCENTRATES SOLD TO INSECTICIDE MANUFACTURERS ONLY

DDT CONCENTRATES • CUBE POWDER • PYRETHRUM PRODUCTS • ACTIVATED SABADILLA • BENZENE HEXACHLORIDE



From the welter of claim and counter claim, Chlordane stands out as:

1. Most *effective* against a wide variety of resistant insects; unusually long-lasting residual property.
2. *Easy and simple* to formulate in emulsions, oil solutions, wettable powders and dusts; Chlordane is completely soluble in all commonly used solvents.
3. Most *versatile;* outstanding in agricultural, household, industrial and veterinary formulations.
4. Most *agreeable* to use, practically odorless, non-staining, non-crystalline. Means satisfied customers and steady repeat business.
5. The toxicant with *unsurpassed profit* possibilities for formulator—dealer—retailer.

Chlordane (Octa-Klor brand) is manufactured in refined and agricultural grades, both of which are 100 per cent active insecticidally. Informative bulletins comprehensively covering specific problems may be had by sending the coupon.

JULIUS HYMAN & COMPANY
Denver, Colorado

Gentlemen: Please send us the following:

☐ Ant Bulletin ☐ Grasshopper Bulletin ☐ Live Stock Bulletin

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Address_____

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Julius HYMAN & Company

DENVER, COLORADO

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Western Sales Office: 9 Main St., San Francisco 5, Calif.